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A MANUAL

OF

MEDICAL JURISPRUDENCE

By the same Author.

THE PRINCIPLES AND PRACTICE OF MEDICAL JURISPRUDENCE. Third Edition. By THOMAS STEVENSON, M.D, F.R.C.P. 2 vols., 8vo., with 188 Engravings. 31*s.* 6*d.*

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A MANUAL

OF

MEDICAL JURISPRUDENCE

BY

ALFRED SWAINE TAYLOR, M.D., F.R.S.

ELEVENTH EDITION

EDITED BY

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LONDON
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1886

PREFACE

TO

THE ELEVENTH EDITION.

THE tenth edition of this well-known work appeared a few weeks before the death of its illustrious author. Though the Manual has had several rivals, it has, nevertheless, held its own; and the tenth edition has been for some time exhausted. Dr. Taylor's experience as a medical jurist was unequalled in this country; and the Manual, like all his works, is written in his usual lucid style.

In editing the work, I have condensed many passages, without, as I trust, detracting from their clearness and fulness; others, which had become obsolete, I have omitted; and much additional matter has been introduced, so as to make the work fairly representative of our existing knowledge of the subject.

T. S.

GUY'S HOSPITAL, LONDON, S.E.,
March, 1886.

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ERRATA.

Page 105, line 4, *for* "consist" *read* "consists."

,, 130, line 15 from bottom, *for* "is commonly" *read* "are commonly."

,, 240, line 20, *for* "Lincoln" *read* "Norwich."

,, 270, line 16, *for* "proved" *read* "produced."

,, 435, line 11 from bottom, *for* "Hoffmann" *read* "E. Hofmann."

,, 542, line 17, *for* "Darnley" *read* "Darley."

MEDICAL JURISPRUDENCE.

MEDICAL EVIDENCE.

CHAPTER 1.

THE PRACTICE OF MEDICAL JURISPRUDENCE.—MEDICAL AND MEDICO-LEGAL DUTIES.—DYING DECLARATIONS.—INSPECTION OF BODIES IN DEATH FROM WOUNDS OR POISONING.—USE OF NOTES.—MEDICO-LEGAL REPORTS.

Medical Jurisprudence—or, as it is sometimes called, Forensic, Legal, or State Medicine—may be defined to be that science which teaches the application of every branch of medical knowledge to the purposes of the law; hence its limits are, on the one hand, the requirements of the law, and on the other, the whole range of medicine. Anatomy, physiology, medicine, surgery, chemistry, physics, and botany lend their aid as necessity arises; and in some cases all these branches of science are required to enable a court of law to arrive at a proper conclusion on a contested question affecting life or property.

The purpose of this work is to bring as far as possible within a small compass those subjects that especially demand inquiry, and which more particularly concern the duties of the educated physician and surgeon. The definition above given necessarily implies that a medical jurist should have a theoretical and practical knowledge of all branches of the profession, a large range of experience, and the rare power of adapting his knowledge and experience to emergencies. He should be able to elucidate any difficult medico-legal question that may arise, and be prepared at all times to make a cautious selection of such medical facts, and a proper application of such medical principles, as may be necessary to enable a judge to place the subject in an intelligible light before a jury, and to enable a jury to arrive at a just conclusion.

The variety of subjects of which a medical jurist is required to have a knowledge, may well alarm a student and lead him to suppose that, as he cannot make himself perfectly acquainted with all, he may well forego the labour of preparing himself in any. But this would be taking an erroneous view of his position. This description of the qualifications necessary to constitute a normal witness in a court of law must not deter him from entering on the study. It is assuredly beyond the mental power of any individual that he should be at the same time profoundly versed in all the principles of medicine and jurisprudence, and that he should be able to answer all possible questions, and encounter and remove all medical difficulties that may occur during the trial of a civil or criminal case. All that the law expects from a medical man is a fair average knowledge, not merely of his profession, but of that which falls more peculiarly under the province of a medical witness. There can be no doubt that the more perfectly a man has made himself master of his profession, the better will he be fitted to follow the principles and apply himself to the practice of medical jurisprudence; but he must divest himself of the notion that these principles can be spontaneously acquired, or that they are necessarily derived from the study of those isolated branches of medicine upon which medical jurisprudence is based. The materials for the medical jurist undoubtedly exist in these collateral sciences: but they require to be assorted, selected, and moulded into shape, before they can be applied to any useful or practical purpose.

The duties of a medical jurist are distinct from those of a mere physician or surgeon; the latter looks only to the treatment of disease or accident, and the saving of life; but the object of the former, in a large proportion of cases, is, whether in reference to the living or dead, to aid the law in fixing on the perpetrator of a crime, or to rescue an innocent person from a falsely imputed crime. Thus he may be required to determine whether, in a particular case, the cause of death was natural or violent; and for this purpose it will be necessary for him to make an entirely new application of his professional knowledge. He has now the difficult task of making a selection from those parts of the medical sciences which bear upon the legal proof of crime.

Some members of the profession have been inclined to look upon medico-legal practice as an unnecessary addition to their ordinary duties; but there are few that have been long engaged in practice, who have not found themselves occasionally placed in situations of difficulty from the accidental occurrence of cases demanding medico-legal investigation. A medical man is summoned to attend a person labouring under the effects of poison criminally administered; but at the time he may have no knowledge, or even suspicion, that poison is the cause of the symptoms. In spite of the best treatment, death ensues: here the functions of the medical man end, and those of a medical witness begin. It is impossible that he can now avoid giving evidence, or shift the responsibility on another—the law will insist on his appearance, first in the court of the Coroner, next before the Magistrates, and afterwards at the Assizes. It will here be assumed that, as a registered member of the profession, he is fully competent to answer every question put to him by judge and counsel relative to the general effects of poisons; the quantity required to destroy life; and the time within which a poison may prove fatal. It may be objected to his evidence, that the deceased had died from the effects of disease, and not from poison; in which case the cross-examination will lead to a searching inquiry into all those diseases which resemble the effects of poison in their symptoms and post-mortem appearances, as well as the means of making an unfailing distinction between them, and the fallacies to which the chemical processes for the detection of poison are liable.

On another occasion a medical man may be called to render assistance to one stabbed in a quarrel, speedily dying from the wound. The office of the surgeon here ceases, while that of the medical jurist commences. He must now be prepared to answer numerous questions, all bearing upon the legal proof of crime, all necessary in law, although apparently superfluous in surgery. Thus he may be asked to state the precise characters of a wound inflicted upon the body of a man soon after death; and by what means a particular wound was inflicted? Was it homicidal or accidental? The amount of blood lost? Whether the person could have moved or performed any act after receiving the wound? Are certain spots found upon his clothes, or upon a knife belonging to him, due to effused blood or to other causes? Whether any, and what statements were made by the dying man, and what were the precise circumstances under which they were made? It need hardly be observed that questions of this nature are rarely noticed, except in a cursory manner, by chemists and surgeons; and a medical man is not likely to acquire the means of answering them by intuition. On the other hand, regarding ourselves as living in a civilized state, in which the detection and punishment of crimes against life and property are indispensable to the security of all, it is impossible to overrate their importance. Unless a witness is able to return answers to these questions when a public necessity occurs, a guilty man may escape punishment, or an innocent man may be condemned. A witness may thus most seriously injure his own reputation, for it is certain that his qualifications as physician, surgeon, or general practitioner, however great, will not shield him from general reprobation.

Thus, then, it is obvious that the duties of a medical jurist are of a highly responsible nature and of great importance to society, while the cases which call them into exercise are of purely accidental occurrence. A medical practitioner who thinks himself secure in the most retired corner of the kingdom, is liable to find himself suddenly summoned as a witness on a trial, to answer questions which perhaps during a long period of practice he had been led to regard as unimportant. Under the circumstances it is scarcely possible that he can avoid exposing his deficiencies, and the final question will be, *Have you ever attended to or thought of these subjects before?* A negative answer to this question, while it commonly brings with it public censure, will in most instances lead to the acquittal of the accused in spite of strong presumptions of guilt.

The truth of this picture will be felt and acknowledged by those who have been a few years engaged in practice. The records of our courts of law contain many unfortunate exposures, which might have been easily avoided had the witnesses only availed themselves of the opportunities afforded to them while students of acquiring a knowledge of the subject; but they had unreflectingly acted on the principle, that medical jurisprudence was a dry, dull, and useless study, and that the practice of it was remote and speculative. This feeling is, however, fast disappearing. Those who have been compelled by circumstances to give their attention to it, have, in subsequent cases, taken care to prepare themselves for the ordeal through which every medical witness must pass.

Some medical men who have treated legal medicine with indifference have ventured to act as witnesses, thinking that the subjects on which they were likely to be examined were so little known to judge and counsel, that even hazardous or rash statements would escape observation: such witnesses, however, have often found to their cost that they were labouring under a delusion. Various circumstances have led to the acquisition of much medico-legal knowledge by lawyers, especially in relation to questions connected with wounds, child-murder, and poisoning; and they are not slow in detecting and exposing a mere pretender who attempts to shelter himself by vague or evasive statements and technical language. Another fact must be borne in mind:—there are few counsel engaged in any civil or criminal case of importance who do not take care to fortify themselves, under medical advice, with a full knowledge of the views of standard medical writers on the subject in dispute; and with these works before them, and with their proverbial acuteness, he must indeed be a clever witness who can succeed in passing off an erroneous or evasive answer to a medico-legal question.

It is a frequent charge against members of the medical profession that they are the worst witnesses on matters of fact and opinion. This is an unmerited censure. Those who are ready to make this charge overlook the number, complexity and difficulty of the questions which are put to medical men compared with those put to other witnesses. They also forget that medical men are much more frequently summoned as witnesses than the members of the two other learned professions. Their evidence obtains much greater publicity, and is necessarily exposed to a wider circle of criticism. The fact is, that good and bad witnesses are to be met with in every profession, and under equal conditions there is no reason to suppose that one would furnish a greater number of incompetent witnesses than another. It is certainly the fault of medical men that they are not always prepared for the questions which are likely to arise in a case on which they know they will be required to give evidence. This want of preparation frequently applies to facts as well as to opinions. Thus, in reference to a case on which a charge of murder or manslaughter may be ultimately founded, a medical man who is called in, omits to observe many circumstances, because at the time they appear to him to have little importance, although at the subsequent trial he may find, to his dismay, that they actually become the turning points of innocence or guilt. Medical observation as a result of professional habits is, on these occasions, in general confined to only one set of circumstances—the recognition and treatment of accident or disease; but medico-legal observation should take a much wider range than this, and should be directed to all the surrounding facts and incidents of a case. The essential difference in the two kinds of practice is, that circumstances which are of no interest in a medical or surgical point of view, are often of the greatest value and importance in legal medicine. It is obvious that if they are not observed by a medical witness when he is first summoned to the injured person, whether dying or dead, it will be out of his power to meet many of the questions which must arise in the progress of the case. The non-observance of these facts is a serious evil, and often carries with it, although unjustly, an imputation of professional ignorance.

The first duty, therefore, of a medical jurist is to cultivate a faculty of minute observation of medical and moral circumstances. This, combined with a general knowledge of what the law requires as evidence, will enable him to meet satisfactorily the scientific questions that may be necessary for the elucidation of a case. The exercise of this faculty is by no means inconsistent with the performance of his duties as a surgeon. A learned judge on one occasion remarked that '*a medical man, when he sees a dead body, should notice everything.*' Undoubtedly he should observe everything which could throw a light upon the production of wounds or other injuries found upon it. It should not be left to policemen to say whether there were any marks of blood on the dress or on the hands of the deceased, or on the furniture in the room. The dress of the deceased, as well as the body, should be always closely examined on the spot by the medical man. It may stimulate the attention of a medical practitioner in reference to these inquiries if he is informed that one art of counsel defending persons charged with murder or manslaughter, consists in endeavouring to discover what he omitted to do. Although sometimes the omission may be really of no medical importance whatever, yet it is usually placed before the jury in such a strong light that the accused obtains the benefit of a doubt. The omission may be attributed to professional ignorance, or, what is worse, to bias—a determination to find proofs of guilt—when the facts might be innocently explained by a want of experience on the part of the witness in dealing with cases of this nature.

If we except medical experts, who are selected according to their experience in different branches of the profession, medical men have no option respecting medico-legal practice; for the cases which give rise to medico-legal questions are always more or less connected with the practice of medicine and surgery. Thus before any inquiry is instituted by a magistrate or coroner, and before any suspicious circumstances have come to light, a medical man may be summoned to a person dying from the effects of a wound, or from the secret administration of poison. The dying person may make to him a declaration or statement as to the circumstances under which the wound was inflicted or the poison administered: he may also mention the names of the person or persons concerned in the assault or the administration. This *dying declaration* or statement, according to the circumstances under which it was made, may become of material importance in the prosecution of a party charged with murder or manslaughter. It is therefore proper that a practitioner should observe and make notes of the *exact condition* of the patient;—whether, when he makes the statement, he is under the conviction or belief that he is about to die. It has been thought that it was also necessary to prove that the wounded man had lost all hope of recovery: but as a judge has justly remarked, it is very difficult, if not impossible, to say on these occasions, when, if ever, the feeling of hope completely deserts a man. Again, a man may express an opinion that he shall "not recover," but this is not sufficient. The law admits these declarations, not because recovery is impossible, but because the person making the statement has in his mind at the time of making it a full conviction of approaching death. It is therefore the duty of the medical attendant on these occasions, to see how far the person making the statement believes that his *death is impending* or approaching. This belief is considered in law to be equivalent to the obligation of an oath.

Hence, when the case is likely to prove fatal, the medical man should warn the patient, in the presence of his relatives or friends, of his dangerous condition. If the wound or poison is not likely to prove rapidly fatal, the attendance of a magistrate to take down the statement in due legal form would relieve the medical man of all responsibility. Should any statement, however, be made to him under these circumstances, it is his duty to make, on the spot, a note of the words actually used. There should be no paraphrase or translation of them, but they should be the very words of the dying man. It is not for the witness, but for the court, to interpret what is thus stated. A medical man on these occasions should not render himself officious in extracting information. He may receive that which is *voluntarily uttered*, and, either immediately or on the earliest possible opportunity, write down the statement as it was made. Any question should be simply confined to the purpose of explaining what may appear to be ambiguous or contradictory in the declaration itself.

In reference to persons who have died from the effects of wounds, poison, or other violent causes, the initiatory proceedings connected with the inquiry usually take place in the court of the Coroner; and unless the medical man in attendance is supposed to be implicated, by maltreatment or otherwise, in the death of the person, the duty of making an examination of the dead body devolves upon him. He may not have seen the person while living; and in this case it will be necessary that he should give his attention to those circumstances which may be of importance in the future inquiry. He should note as far as it can be ascertained:—1. The exact time of death, if known, and thus determine how long a period the person survived. 2. The attitude, position, and condition of the body. 3. The state of the dress. 4. All surrounding objects. Any bottles, paper-packets, weapons, or spilled liquids lying about should be collected and preserved, and their position with regard to the body of the deceased should be noted. 5. Any vomited matters near the deceased should be collected. In making a *post-mortem examination* of the body the following additional points should be attended to. 6. The external appearance of the body, and whether the surface is livid or pallid. 7. The state of the countenance. 8. All marks of violence on the person, discomposure of the dress, marks of blood, etc. 9. The situation, form, and direction of all wounds. 10. The presence or absence of warmth in the legs, arms, abdomen, mouth, or armpits. 11. The presence of cadaveric rigidity in any part of the body. To give any value to the two last-mentioned characters, it is necessary for the practitioner to observe the nature of the floor on which the body is lying,—whether the body is clothed or naked, young or old, fat or emaciated. These conditions create a difference, in respect to the cooling of the body and the access of rigidity. 12. If found dead—when was the deceased last seen living, or known to have been alive? 13. All circumstances leading to a suspicion of suicide or murder. 14. The time after death at which the inspection was made. 15. The state of the abdominal viscera. If the stomach and intestines are found inflamed, the seat of inflammation should be exactly specified; also all marks of softening, ulceration, effusion of blood, corrosion, or perforation. The stomach should be removed and placed in a *separate vessel*, a ligature being applied to each end. If cut open for examination at this period, this operation should be performed in a clean dish, and with such care that none of the contents are lost or are allowed to mix with the contents of the intestines. 16. The contents of the stomach, if this organ was opened during the inspection, should be collected in a clean *graduated* vessel :—notice *a*, the quantity; *b*, the odour tried by several persons; *c*, the colour; *d*, acid or alkaline reaction; *e*, presence of blood, mucus, or bile; *f*, presence of undigested food; and it may be as well to observe, that the presence of farinaceous matters (as bread) would be indicated by the addition of iodine water, if the contents were not alkaline—of fat, by heat; *g*, other special characters. 17. The contents of the duodenum should be separately collected, ligatures being applied to it. 18. The state of the large intestines, especially the rectum, and the condition of their contents. The discovery of hardened fæces in the rectum would prove that purging had not existed recently before death. 19. The state of the windpipe, throat, and gullet, and whether there are in these parts any foreign substances, or marks of inflammation and corrosion. This is of essential importance, as it throws a light upon a variety of questions which may arise respecting death by suffocation from mechanical causes, or the nature of a substance swallowed. 20. The state of the lungs and heart; morbid changes, etc. 21. The state of the brain and spinal marrow. 22. The condition of the womb, ovaries, and genital organs, as in the female poison has been sometimes introduced into the system by the vagina, or wounds have been inflicted internally. 23. The kidneys and the spleen should be submitted to examination. 24. The liver with the gall bladder should be removed for chemical examination. 25. The urinary bladder, with any fluid contained in it, should be removed and placed in a separate jar.

Such are the points to which, in the greater number of cases of violent death, a medical jurist should give his attention. By means of these data, noted according to the particular case to which they are adapted, he will in general be enabled, without difficulty, to determine the probable time of death, and the actual means by which death was brought about. He may thereby have it in his power, if the case be one of poisoning, to point out the dish or article of food which had contained the poison, and to throw light upon any disputed question of suicide or murder in relation to the deceased. Many cases of death from wounds or poison are rendered obscure, owing to these points not having been attended to in the first instance.

It is not necessary in this place to enter into any details respecting the mode of performing an *inspection*. A medical practitioner is supposed to have acquired a knowledge of this part of his duties during his study of anatomy; and any additional information which may be required will be found in the appropriate sections of this work. The only essential points in addition to those above mentioned, are, 1. To examine all the important organs for marks of natural disease: and 2. To note down any unusual pathological appearances or abnormal deviations; although they may at the time appear to have no bearing on the cause of death. It is useful to bear in mind on these occasions that the body is inspected, not merely to show that a person has died from poison, but to prove that he has *not* died from any *natural cause*. Medical practitioners commonly give their attention exclusively to the first point; while lawyers, who defend accused parties, very properly direct a most searching examination to the last-mentioned point, *i.e.* the healthy or unhealthy state of those organs which are essential to life. The usual causes of *sudden death* have their seats commonly in the brain, the heart and its great vessels, or in the lungs. Marks of effusion of blood, congestion, inflammation, suppuration, or a diseased condition of the valves of the heart, should be sought for and accurately noted. It has also been recommended that an examination of the spinal marrow should be made. If the cause of death is obscure after the general examination of the body, there is good reason for inspecting the condition of this organ.

Exhumation of Bodies.—Sometimes the inspection of a body is required to be made long after interment. So long as the coffin remains entire, there may be the expectation of discovering certain kinds of mineral poison in the organs; but decomposition may have advanced so far as to destroy all pathological evidence. The inspection in such cases is commonly confined to the abdominal viscera. The stomach is often found so thin and collapsed that the anterior and posterior walls appear to form only one coat. This organ should be removed, with the duodenum, and ligatures should be applied to each. The liver and the spleen should also be removed, in order that they may, if necessary, be separately analysed. If poison is not found in one of these parts, it is not likely that it will be discovered in other parts of the body. It has been recommended that a portion of earth immediately above and below the coffin should be removed for analysis, as it may contain arsenic; but this appears to be an unnecessary piece of refinement when the coffin is entire, or when the abdominal parietes still cover the viscera. If decomposition has so far advanced as to have led to an admixture of earth with the viscera, and the poison is found in minute quantity in the tissues only, the source of the poison may be regarded as doubtful; and in this case the earth in which the remains are found should undergo a chemical examination.

The body of a deceased person, when exhumed, should be identified by some friend or relative in the presence of the medical examiner. In a case of murder by poison, the evidence almost failed, owing to this precaution not having been taken.

It is important that the viscera taken from a body which has been long in the grave should be sealed up immediately. They should not be allowed to come in contact with any metal, nor with any surface except that of clean glass, porcelain, or wood. It has been recommended that they should be washed with chloride of lime or carbolic acid; but this is decidedly improper; the use of any preservative chemical liquid would not only embarrass the future analysis, but would render a special examination of an unused portion of the liquid necessary, the purity of which would have to be unequivocally established. Preservation from air in clean glass vessels, with well-fitted corks covered with gutta-percha tissue, is all that is required in practice.

Identity of Substances.—It is necessary to observe that all legal authorities rigorously insist upon proof being adduced of the *identity* of the vomited matters or other liquids taken from the body of a deceased person, when poisoning is suspected. Supposing that, during the examination, the stomach and viscera are removed from the body, they should never be placed on any surface or in any vessel until it has been first ascertained that the surface or vessel is perfectly *clean.* If this point be not attended to, it will be in the power of counsel for the defence to raise a doubt in the minds of the jury, whether the poisonous substance found might not have been accidentally present in the vessel used. This may be regarded as a very remote presumption; but, nevertheless, it is upon technical objections of this kind that acquittals follow in spite of the strongest presumptions of guilt. This is a question for which every medical witness should be prepared, whether he is giving his evidence at a coroner's inquest or in a court of law. Many might feel disposed to regard matters of this kind as involving unnecessary nicety and care; but if they are neglected it is possible that a trial may be at once stopped, so that the care subsequently bestowed upon a chemical analysis will be labour thrown away. Evidence of the presence of poison in the contents of a stomach was once rejected at a trial for murder, because they had been hastily thrown into a jar borrowed from a neighbouring grocer's shop; and it could not be satisfactorily proved that the jar was clean and entirely free from traces of poison (in which the grocer dealt) when used for this purpose. When the life of a human being is at stake, as in a charge of murder by poisoning, the slightest doubt is always very properly interpreted in favour of the accused.

Not only must clean vessels be used for receiving any article destined for subsequent analysis, but care must be taken that the *identity* of a substance is preserved, or the most correct analysis, afterwards made, will be inadmissible as evidence. The suspected substance, when once placed in the hands of a medical men, should never be let out of his sight or custody. It should be kept sealed under his private seal, and locked up, while in his possession, in a closet to which no other person has a key. If he has once let the article out of his hands, and allowed it to pass through the hands of several other persons, then he complicates the evidence for the prosecution, by rendering it indispensable for these persons to state under what circumstances it was placed while in their possession. The exposure of a suspected substance on a table, or in a closet or room to which many have access, may be fatal to its identity; for the chemical evidence, so important in a criminal investigation, will probably be altogether ejected by the court. When any article (e.g. a stomach) is reserved for analysis, care should be taken to at once attach *immovably* to it, or to the vessel containing it, a label, upon which is plainly written the name of the deceased and the date of removal. This is especially necessary when there are two or more articles for analysis. The greatest inconvenience has resulted from the neglect of this simple precaution.

Preserving articles for Analysis.—In removing viscera or liquids from the body, and reserving them for analysis, it is necessary to observe certain precautions. A clean vessel with a wide mouth should be selected; it should be only sufficiently large to hold the organ or liquid (the less air remaining in it the better); it should be secured by a closely fitting cork, covered with gutta-percha tissue or bladder. Another piece of sheet caoutchouc or gutta-percha should then be tied over the mouth. In this way any loss by evaporation or decomposition is prevented, and the viscera may be preserved in a cool place for some time. If the mouth of the vessel be too wide for a cork, the other articles cannot be dispensed with. Paper only should not be used, as the appearances after death in the viscera may be entirely destroyed by the evaporation which takes place through the layers of paper with which the vessel containing them is covered. The practitioner should bear in mind that all these matters are likely to come out in evidence. For reasons already stated, antiseptic chemical compounds should not be used.

The articles used for the preservation of viscera should be in all cases scrupulously examined. Some kinds of calico are dressed with arsenic and starch paste, and many kinds of wrapping-paper as well as wall-papers are strongly impregnated with this poison. One observation shows that this is not an unnecessary caution. A medical man was engaged in examining the body of a child, in order to determine the cause of death. The organs were healthy, and as no sufficient cause presented itself, he removed the stomach with a view of making an analysis of its contents. He was suddenly called away; and, to preserve the stomach, he wrapped it in a piece of paper (used for papering rooms), placing it on the uncoloured side, and he locked it in a closet until the following day. Assisted by a friend, he then analysed the contents, and found a trace of morphine with a pretty large quantity of arsenic. As the symptoms from which the child had died were not those of poisoning with arsenic, and there were no appearances of the action of this substance on the body, he came to the conclusion that its presence must have been owing to some extraneous cause. He examined a portion of the wall-paper in which the stomach had been wrapped, and then found that that part of it which was coloured yellow was tinted with sulphide of arsenic, or orpiment. It was therefore evident, as commercial orpiment contains white arsenic, that the stomach and its contents had imbibed a portion of the poison during the night. ('Lancet,' 1855, i. p. 632.) This satisfactorily accounted for the presence of arsenic, under circumstances which might have given rise to a false charge of murder. Many wall-papers contain arsenic, and this arsenic spreads by imbibition to other parts of the paper not so tinted. It would, of course, be proper to avoid in all cases the use of any wrapper having upon it mineral colours of any description. The above case shows in a striking point of view the danger of trusting to chemical analysis alone. Unless we look to physiology and pathology, an erroneous opinion may be expressed.

The results of an analysis, in the shape of sublimates or precipitates, should be preserved as evidence, distinctly labelled in small glass-tubes, hermetically sealed. They can then, if asked for, be produced for examination at the inquest or trial.

On the use of Notes.—It has already been recommended, as a rule in these investigations, that a medical practitioner should make notes of what he observes in regard to symptoms, appearances after death, and the results of analysis. His own observations should be kept distinct from information given to him by others. He may base his conclusions on the former, but not on the latter until given in evidence. From the common forms of law in this country, a person charged with a crime may remain imprisoned, if at a distance from the metropolis, for some months before he is brought to trial. It is obvious, however clear the circumstances may at the time appear to a practitioner, that it will require more than ordinary powers of memory to retain, for so long a period, a distinct recollection of all the facts of the case. If he is unprovided with notes, and his memory is defective, then the case will turn in favour of the prisoner, who will be the person to benefit by the neglect of the witness. In adopting the plan here recommended, such a result may be easily prevented. It may be remarked that the law relative to the admissibility of notes or memoranda in evidence is very strict; and in trials for murder is rigorously enforced by the judges. In order to render such notes or memoranda admissible, it is indispensably necessary that they should have been taken on the spot at the time the observations were made, or as soon afterwards as practicable; and, further, it must be remembered that a witness can refer to them only for the purpose of refreshing his memory. If from indistinctness of writing or other causes a copy of the notes has been subsequently made,—a witness should not destroy the original notes, but have them ready for production. He must also be prepared to give a reasonable explanation of any alterations or interlineations which may appear in his original notes. So in reference to all other written memoranda connected with the case, as, for example, the medicines prescribed for the deceased, the visits made to him, etc., the witness should be prepared to produce them and explain any remarks which may be found in his books. Counsel are entitled to look at and examine all documents of this kind which are produced or used by the witness in giving his evidence in the superior courts.

Medico-legal Reports.—One of the duties of a medical jurist is to draw up a report of the results of his examination: 1, in regard to symptoms; 2, in regard to appearances after death; and 3, in regard to the results of an analysis. With respect to the first two divisions of the report, the reader is referred to the rules for investigating cases of poisoning (pp. 6, 7, 8). It need hardly be observed that the time at which the person was first seen, and the circumstances under which the attendance of the practitioner was first required, as well as the time of death, should be particularly stated. The hour, the day of the week, and the month, should be invariably mentioned. Some medical witnesses merely state the day of the week, without that of the month, or vice versâ. At a trial this sometimes creates great confusion, by rendering a reference to almanacs necessary. The words yesterday, next day, etc., should never be used. The facts which it will be necessary to enter in the report are specially stated under the heads of investigation (see p. 8). If these facts are not observed in the order there set down, their value as evidence of the cause of death, or of the criminality or innocence of particular persons, will be lost.

In drawing up a report of symptoms and appearances after death, the facts should be first plainly and concisely stated seriatim, in language easily intelligible to non-professional men. A reporter is not called upon to display his erudition, but to make himself understood. If technical terms are employed, their meaning should also be stated. When a subject is thoroughly understood, there can be no difficulty in rendering it in simple language; and when it is not well understood, the practitioner is not in a position to make any report. Magistrates, coroners, and barristers easily detect ignorance, even when it appears under the mask of erudition.

In recording facts the reporter should not encumber his statements with opinions, inferences, or comments. The facts should be first stated and the conclusion should be reserved until the end of the report. The language in which conclusions are expressed, should be precise and clear. It must be remembered that these are intended to form a concise summary of the whole report, upon which the judgment of a magistrate, or the decision of a coroner's jury, will be ultimately based. They should be most strictly confined to the matters which are the subject of inquiry, and which have actually fallen under the observation of the witness. Thus, they commonly refer to the following questions:—What was the cause of death? What are the medical circumstances which lead you to suppose that death was caused by violence? What are the circumstances which lead you to suppose that death was *not* caused by natural disease? Answers to one or all of these questions comprise, in general, all that the reporter is required to introduce into the conclusions of his report.

The reporter should remember that his conclusions are to be based only upon *medical* facts,—not upon moral circumstances, unless he is specially required to express his opinion with regard to them. Further, they must be founded only on what *he has himself seen or observed.* Any information derived from others, should not be made the basis of an opinion, either in evidence or in a medico-legal report. It is scarcely necessary to remark that a conclusion based upon mere *probabilities* is of no value as evidence.

In drawing up a report on the *results of a chemical analysis*, the following rules may be borne in mind. A liquid or solid is received for analysis. 1. When, from whom, and how received? 2. In what state was it received—secured in any way, or exposed? 3. If more than one substance received, each to be separately and distinctly labelled; the appearance of the vessel, its capacity, and the quantity of liquid (by measure) or solid (by weight) contained therein, noted. 4. Physical characters of the substance. 5. As to processes and tests employed for determining whether it contained poison. These processes need not be described;—a general outline of the analysis will suffice. 6. Supposing the substance to contain poison—was this in a pure state or mixed with some other substance? 7. The strength of the poison, if an acid, or if it be in solution: in *all* cases, the *quantity* of poison found. 8. Supposing no poison to be contained in it, what was the nature of the substance? Did it contain anything of a noxious nature, *i.e.* likely to injure health or destroy life? 9. Could the supposed poisonous substance exist naturally or be produced within the body? 10. Was it present in any of the liquids or solids employed in the chemical analysis? 11. Was it contained in any of the articles of food or medicine taken by the deceased? 12. Is its presence to be ascribed to the use of any mineral matter employed by injection after death for the preservation of the body of the deceased? 13. What quantity of poison was actually separated in the free or absorbed state? 14. How much of the substance found would, under the circumstances, be likely to destroy life? There are few reports in which answers to some of these questions, although not formally put, will not be required; and unless they are borne in mind by the operator at the time an analysis is undertaken, those which are omitted can never receive an answer, however important to the ends of justice that answer may ultimately become.

There are frequently defects in these reports which it is desirable to point out. The statements are sometimes drawn up in exaggerated language: at others they are overloaded with technical, and therefore unintelligible terms, and the writer is not careful enough to keep his facts distinct from his comments. The former may be useful as evidence; the latter are inadmissible. With respect to the first of these defects, it is too much the practice of medical men, in drawing up reports of medical cases for professional purposes, to use exaggerated language. Thus it may be observed in the description of an ordinary post-mortem examination, the lining membrane of the stomach is described as being 'intensely' inflamed, or some part is 'considerably' injected, or a cavity is 'enormously' distended. Expressions thus loosely employed, convey to the legal mind a widely different meaning from that intended by the reporter. They create also, if withdrawn or modified, great difficulty in evidence, and at the same time they place the witness in an undesirable position before the court. On the other hand, if retained, they may render the facts unsusceptible of explanation upon any theory of natural disease. Such descriptions obviously imply a comparison with similar conditions in numerous other dead bodies; but what is the standard by which they are really measured, and what opportunity has the witness had of creating such a standard from his own experience? In general it will be found that such expressions have been used, without proper consideration, from a habit acquired by the writer in reporting cases for the information of medical men only. Let him who is inclined to use them, bear in mind that barristers look much more closely to the strict meaning of words than medical men, and that they are always disposed to distrust the judgment of one who cannot speak or write without resorting to the use of the superlative degree.

The free use of *technical terms* in drawing up reports may be attributed to a similar practice in the profession. Putting aside those cases in which a medical man believes that he is displaying his erudition by the selection and use of such terms, there can be no doubt that the greater number of medical practitioners fall into this practice from mere habit. They write as if they were addressing the report to some medical society, instead of a coroner and jury who have never in their reading or experience met with such terms, and to whom therefore they are unintelligible. In a report on the appearances in the body of a man who had suffered from chronic insanity, which was submitted to the author for explanation, the following passage occurred:—'The only morbid appearance in the brain was an atheromatous deposit in the Pons Varolii, near the situation of the locus niger.' In another document the reporter stated for the information of a coroner's jury, that the 'integuments of the cranium were reflected, and the calvarium was exposed.' If a reporter will use such terms as these or others of a similar kind, such as 'parietes of the abdomen,' 'epigastrium,' 'hypertrophy of the liver,' when it would require no more trouble to put what he means in plain English, he must be prepared to have his meaning perverted or wholly misunderstood. Setting aside the men who act as jurors, it may be observed that educated persons, such as coroners and magistrates, do not commonly include professional terms within the range of their studies. There are but few of them who understand the difference between perineum and peritoneum, or the meaning of the words hemispheres of the brain, pia mater, puncta cruenta, corpora quadrigemina, centrum ovale, etc. They are not likely to know the difference between the cardia and pylorus, nor the nature or situation of the duodenum, jejunum, ileum, or cæcum, and are as ready to consider them to be parts of the liver or urinary bladder as of the intestines. On one occasion, a judge asked for an explanation of the meaning of the term 'alimentary canal;' on another he was entirely ignorant as to the meaning of 'verdigris.' A slight consideration will show to any medical practitioner, that refined professional language is wholly misplaced in a report which is intended to inform and convince the minds of ordinary men upon plain matters of fact.

The last point which calls for comment in reference to medical reports, is the loose manner in which facts, comments on facts, and hearsay statements are sometimes found blended. If a reporter takes care to separate facts from comment, his report is admissible, and may be read at the inquest or trial as evidence. The facts are for the jury—the comments upon the facts, introduced by the reporter, may or may not be correct, and are therefore not evidence. Their correctness or relevancy to the case will be elicited in the cross-examination. As a rule, nothing should be entered in a report which is not connected with the subject of inquiry, nor except it has actually fallen under the observation of the reporter. The introduction of statements made by others, or of circumstances which have come to his knowledge through public rumour, should be carefully avoided.

Upon the medical report, and such evidence as may be required to explain it, an accused person may be committed for trial at the Assizes, either by a coroner or magistrate. In the first stage of the proceedings, under these circumstances, the medical witness goes before the grand jury, and there, after the administration of an oath, he is required to make a general statement of what he knows of the matter. Such questions are put as may be necessary to elucidate the cause of death; and on the finding of a true bill, the accused is placed upon his trial before one of the judges of assize. According to the variable circumstances attending such cases, the medical evidence is called for at an early or late stage of the proceedings. When it is at all doubtful whether the cause of death was owing to any criminal act, it is called for at the commencement of the case in order to lay a foundation for further inquiry.

It is necessary that a medical witness should remember that copies of his report and depositions, either before a coroner or magistrate, are usually placed in the hands of counsel as well as of the judge, and that his evidence, as it is given at the trial, is compared word for word with that which has been already put on record. There is reason to believe that this is not generally known to members of the medical profession, and thus it happens that either from failure of memory, want of accurate observation, or carelessness in giving evidence, medical witnesses have laid themselves open to severe censure, either by stating matters differently at the trial, or by giving a different complexion to the facts. Any serious deviations from what is on record will of course tell unfavourably for the witness, supply ample materials for a severe cross-examination, and form an excellent ground of defence for the prisoner. The witness's weakness is the prisoner's opportunity, and of course counsel for the defence will not lose the occasion of impressing upon the jury that a man who can on oath give two different accounts of the same transaction, is not to be believed on either.

CHAPTER 2.

CORONERS' INQUESTS.—TRIAL AT THE ASSIZES.—OBEDIENCE TO SUBPŒNAS.—MEDICAL FEES.—EXAMINATION IN CHIEF.—DUTIES OF MEDICAL WITNESSES.—QUOTATIONS FROM BOOKS.—PRESENCE IN COURT.—TECHNICAL TERMS.—LICENSE OF COUNSEL—RULES FOR THE DELIVERY OF EVIDENCE.

Coroners' Inquests.—The proceedings at coroners' inquests are treated too lightly by medical men. The ignorant and uneducated class of persons who often constitute the jury, as well as the circumstances under which the inquiry usually takes place, are not calculated to inspire great respect for these initiatory proceedings; but still by law and custom coroners' inquisitions are, and have been for ages in this country, the only tribunals for inquiring into and determining the cause of death in cases of suspected violence; and they are therefore deserving of more attention than is usually shown to them by medical witnesses. As a rule, in all inquests which are likely to end in a committal of the accused person, a medical man who is giving his evidence before a coroner in the room of a small country inn or in a village school-room, is virtually delivering it before a judge of assize; and this fact alone, if not a respect for the court, should induce him to give his evidence guardedly, and with a due consideration to the serious results to which it may ultimately lead. The statute 4th Edw. I., st. 2, on which coroners profess to act, directs that 'upon information,' they shall 'go to the place where any be slain or suddenly dead,' and make due inquiry as to the cause, etc., before a jury selected from persons living in the neighbourhood. The information upon which a coroner generally acts is—1. Notice from a beadle, or other officer of the parish (whose zeal is sometimes stimulated by a fee or salary), of any death from sudden or supposed unusual causes. 2. Notice from a medical man who may have attended the deceased, and who communicates his suspicion that the cause of death was not natural.

3. Notice from a registrar of deaths that no cause has been assigned in a particular case, or that there has been a rapid death after a short illness. The conclusion to which experience leads in reference to these inquiries is, that the system affords no certainty for the detection of crime; that it affords no protection to those who are wrongly charged with crime; and lastly, that in some cases it screens a criminal by a verdict based upon an imperfect inquiry, in which the important medical facts are either not understood or are misinterpreted by the jury.

Many persons who occupy the office of coroner are neither medically nor judicially qualified for the proper performance of the duties of the office. The system of electing a man to hold such an office as this (one demanding special *medical* knowledge of the causes of death, and good *legal* knowledge of the law of evidence) by freeholders of the lowest degree, is so intrinsically absurd, that it is quite wonderful how, with improved civilization, it has maintained its ground in such a country as England. The election of a Lord Chancellor, of the Judges of our Courts of Law, or of County Court Judges, might be with equal reason left in the hands of voters of this class—men who have no knowledge of the duties of the office, or of the skill and learning required of one who is really competent to fill it. The election of a good and capable person as coroner, is therefore a matter of pure accident. No preliminary test of ability or capacity is required.

In Scotland, the office of coroner does not exist; but in place of this, there is an officer named Procurator Fiscal, generally a skilled solicitor, nominated by competent authority, and not elected by scot and lot voters. The general order issued to these officers by the Lord Advocate, enjoins that in cases where a dead body is discovered, the Procurator Fiscal shall obtain a medical report of the cause of death; and in cases of persons found dead, the body is generally inspected for this purpose. This, however, is at the option of the appointed officer, the instruction being in these words:—'Wherever, in his opinion, a written medical report is necessary for the due consideration of the case, he, the Procurator, shall obtain such a report from a duly qualified medical practitioner.' The usual practice in England is to select the *nearest* medical practitioner, whether he has had any experience or not, and often to trust an important and delicate pathological inquiry in the hands of one who probably has never before made an inspection.

Under the present system coroners are empowered by the Medical Witnesses' Act (6 and 7 William IV. c. 89) to issue an order for the attendance of any legally qualified practitioner, 'at the time in actual practice in or near the place where the death has happened.' A fee of two guineas is the maximum allowed for making a post-mortem examination, and, if considered necessary by the jury, a chemical analysis of the stomach and intestines. A penalty of five pounds is attached to disobedience of this order, except for reasonable cause. Rumsey has correctly represented the unsatisfactory position in which medical men are placed by such an arrangement. He observes: 'It is no discredit to a practitioner engaged in the toilsome routine of ordinary medical duties, if he should feel himself at a loss when called upon for a decisive opinion in some obscure case of poisoning or infanticide. His scanty opportunities for the study of these subjects and for making post-mortem examinations cannot suffice to qualify him for answering the delicate and important questions which he must answer before a jury can find a proper verdict.' . . . 'The custom of indiscriminately summoning medical practitioners of all sorts, and of all degrees of pathological knowledge and forensic skill, has sadly depreciated the value of medical evidence in Courts of justice.' ('Essays on State Medicine,' p. 356.)

No medical man can be compelled to undertake that which he feels incompetent to perform; and some medical practitioners who have felt this want of experience have properly declined to make chemical analyses involving so serious a responsibility. It is thus that, in cases of importance, analyses for coroners' inquests are now referred to experts appointed by the Home Secretary, and the practitioner discharges himself of that responsibility which the Medical Witnesses' Act imposes upon him without any adequate remuneration. A coroner can always obtain this assistance free of cost on application to the Home Secretary.

Before quitting this subject, it is necessary to observe that medical man are too ready to give their opinions of the cause of death for a coroner's inquest without making an inspection of the body. No man is compelled to give an opinion upon insufficient data, and if by the institution of a judicial inquiry there are grounds for believing that a death has not been natural, no medical opinion of the cause should be given in the absence of an inspection. Such an opinion must always be conjectural, and may involve the medical man in an unpleasant responsibility.

Trial at the Assizes.—The next stage of the proceedings in a criminal case brings a medical witness before a superior court. For this purpose the witness is bound over by the coroner or magistrate, or a *subpœna* is issued. It need hardly be observed that every witness is bound to obey a subpœna, when with it, his reasonable expenses for the journey, etc., are tendered to him; but he is not bound to attend the trial except upon a subpœna or when bound over. There are some questions connected with this subject which it will be proper to consider in this place. *If a subpœna is served on an ordinary or skilled medical witness, is he bound to obey it?* In *Betts* v. *Clifford* (Warwick Lent Ass., 1858) Lord Campbell stated, in answer to a question, that a *scientific witness* was not bound to attend upon being served with a subpœna, and that he ought not to be subpœnaed. If the witness knew any question of *fact* he might be compelled to attend, but he could not be compelled to give his attendance to speak to matters of *opinion.*

In *Rich* v. *Pierpoint*, an action for malapraxis, Lee was summoned against his will to give evidence on the part of the plaintiff. He stated that on the evening before the trial a solicitor called on him and left a subpœna with him. Lee would not hear any account of the case which the solicitor proposed to give, and expressed his resolution to have nothing to do with the trial. The solicitor informed him that he would be required to pay the usual penalty if he did not attend. He went to Kingston, and was warned not to leave the Court until the trial was over. He heard the evidence on the part of the plaintiff, and upon this and the medical evidence he gave his opinion—not much in favour of the party who summoned him, and not much against him. Lee considered that he could not avoid attending the trial under these circumstances. ('Med. Times and Gaz.,' 1862, i. p. 389.)

In the case of *Webb* v. *Page* ('Carrington and Kirwan's Reports,' p. 23) the late Maule, J., ruled as follows:—'There is a distinction,' said his Lordship, 'between the case of a man who sees a fact and is called to prove it in a court of justice, and that of a man who is selected by a party to give his opinion on a matter on which he is peculiarly conversant from the nature of his employment in life. The former is bound, as a matter of public duty, to speak to *a fact* which happens to have fallen within his own knowledge, for without such testimony the course of justice must be stopped. *The latter is under no such obligation*; there is no such necessity for his evidence, and the party who selects him must pay him.' In the case referred to, a skilled witness had been subpœnaed, but he refused to give evidence unless first paid for his services and loss of time ('Med. Times and Gaz.,' 1862, i. p. 432). A barrister, who quotes this ruling, goes on to say: 'There is one reason why I should not advise any person in the position of a skilled witness totally to disregard a subpœna. It is quite clear that should such a person fail to attend a trial no attachment could issue, even if he were called as is usual upon the subpœna, because the party subpœnaing him could not make the requisite affidavits that he was damnified by the witness's absence, and in what respect. But such party might bring an action for damages; and although he would recover none, he might not only worry, but might even put the defendant to a considerable expense, as taxed costs by no means include the entire costs in such cases. Although, therefore, I could not advise a total neglect of the subpœna, the safest course would be to obey it, and demand expenses before giving evidence. Such expenses would be only those allowed for a professional witness (not special fees), but if the person so subpœnaed were willing to run the risk of an action, he might safely absent himself without any fear of an attachment from the court for contempt.' With regard to the question whether a skilled witness would be permitted to demand a high fee for his attendance under such circumstances, the writer adds: 'To permit him legally to demand a high fee would perhaps look somewhat like legally countenancing a bribe.' At all events there is no such legal recognition.

In a case which came before the Court of Exch. (*Maxted* v. *Morris*, May, 1868), a witness wilfully disobeyed a subpœna. In consequence of this the trial was postponed, and the parties were put to great expense. An arrangement was made by which the witness bound himself to pay a part of the expenses. The *Chief Baron* said: It must be distinctly understood that in all cases where it appeared to the court that there had been a wilful disobedience of a subpœna after proper service, such a contempt of court would be visited with the punishment it deserved. *Martin, B.*: It was not to be tolerated that a man should exercise any discretion as to whether he would or would not attend a court in pursuance of subpœna. Enormous costs were incurred in preparing a case and bringing it down to trial, the whole of which were to be thrown away and wasted, because a man refused to obey a lawful summons to attend as a witness. *Pigott, B.*: A subpœna was not to be treated as mere waste paper. Public justice required that persons wilfully committing contempt of court should be dealt with in such a manner as to teach them that they could not commit a contempt of court with impunity.

Lord Campbell's dictum in reference to the distinction between fact and opinion confers no practical benefit on witnesses. It is at all times difficult in science, and in the medical sciences particularly, to separate them; and if a man appears to testify to a medical or scientific fact, he cannot avoid giving an opinion arising out of the fact. In an action against a druggist for a mistake in compounding medicine, an attempt was made to procure the author's *opinion* as a skilled witness at the trial, by reason of *facts* obtained from the report of a chemical analysis, the real object of which was at the time entirely concealed. The suit was fortunately compromised, and attendance was not necessary, but such a case should convey a caution to chemical experts. They may be employed secretly and under untrue statements to make analyses; these become *facts* on which they may be summoned like ordinary witnesses to give *opinions* as skilled witnesses, while the payment of the usual fee for a skilled witness is evaded.

It would appear from the following case (*Maskerry* v. *O'Connor*, Q.B., June, 1873) that medical men residing within the 'Bills of Mortality' are placed under exceptional circumstances. The plaintiff, a girl seven years old, appeared by her father, claiming damages of the defendant by reason of personal injuries sustained from careless driving. Leslie was called to prove the nature of the injuries, but he declined to give evidence unless his medical fees were first paid. It appeared that he had been served with a subpœna without any fee. A shilling was then tendered to him, but he still declined to give evidence until either his expenses were paid or there was an undertaking to pay them. Quain, J., ruled that as Leslie resided within the 'Bills of Mortality,' all that he was entitled to was one shilling on his subpœna. The witness then produced a report of a case in which a medical man had successfully insisted on his fees being paid before giving evidence, but it appeared that he did not reside within the 'Bills of Mortality.' Leslie was accordingly sworn. The jury returned a verdict of damages against defendant, and the judge refused to certify. It may be remarked of these Bills, which were commenced in 1592, that since 1840 they have been superseded in fact but not in law by the Registrar-General's weekly returns. They included latterly 148 parishes in Middlesex and Surrey, but excluded the large parishes of Marylebone and St. Pancras. The payment of medical fees should not depend upon the witness living within or without an antiquated boundary of this kind.

In a case tried at the Carnarvon Assizes, Aug. 1872, a medical man had refused to sign the depositions which had been taken before the magistrates without being guaranteed a higher fee than that allowed by the county tariff. Bovill, C.J., told the witness that the Act of Parliament imposed an obligation upon him, and he had no power to refuse, and if he did so on another occasion he would be liable to be indicted for disobedience. The judge held that a medical man has no right to fix the amount of his expenses, but must always take the allowance which the law gives him. ('Lancet,' 1872, ii. p. 204.)

Medical Witnesses.—Assuming that the medical man has obeyed a subpœna, he will now be required to attend before the court, and to state, in the face of adverse counsel, the opinions which he has formed from the medical facts of the case, as well as the grounds for these opinions. He will then, for the first time, undergo the ordeal of a public examination. Some medico-legal writers have considered it necessary to lay down rules respecting the manner in which a medical witness should give his evidence; how he is to act on a cross-examination, and in what way he is to recover himself on re-examination. Any advice upon this head appears to be quite superfluous; since experience shows that these rules, like those given to prevent drowning, are invariably forgotten at the very moment when a person is most in need of them. A man who goes to testify to the truth to the best of his ability should bear in mind two points: 1. That he should be well prepared on all parts of the subject on which he is about to give evidence. He should act on these occasions upon the advice contained in the Latin motto, *ne tentes aut perfice.* 2. That his demeanour should be that of an educated man, and suited to the serious occasion on which he appears, even although he may feel himself provoked or irritated by the course of examination adopted. A medical witness must not show a testy disposition in having his professional qualifications, his experience, his means of knowledge, or the grounds for his opinions very closely investigated: he should rather prepare himself to meet with good humour the attempts of an adverse counsel to involve him in contradiction, and show by his answers that he has only a desire to state the truth. Law and custom have long established that a barrister, in defending a prisoner, has a right to make use of all fair, and even what may appear to the witness unfair, means for the defence. Nothing can tend more to lower a witness in the opinion of the court and jury, or diminish the value of his evidence, than the manifestation of a disposition to deal with his examiner as if he were a personal enemy, to evade the questions put, or to answer them with flippancy or anger. All such exhibitions invariably end in the discomfiture of the witness.

It has been suggested that medical men on these occasions might take a lesson from lawyers, and observe how little they allow forensic differences, which they put on with their professional costume, to influence them in their intercourse with each other or with an adverse judge or jury.

Scientific experts sometimes lay themselves open to rebuke by setting up a claim of infallibility. In the English courts this is unusual, but in France and Italy, where argument is allowed, it is frequently witnessed. In a trial at Florence, involving a medico-legal question, the medical expert exclaimed in full court, '*Se sbaglio io, sbaglia la scienza.* If I err, science errs.'

Medical men have complained, and on many occasions justly, of the *licence of counsel.* On this subject it may be well to consider what has been said by a late high authority on the Bench, Erle, C.J.:—'The law trusts the advocate with a privilege in respect to the liberty of speech which is in practice bounded only by his own sense of duty; and he may have to speak upon subjects concerning the deepest interests of social life, and the innermost feelings of the soul. The law also trusts him with a power of insisting upon answers to the most painful questioning, and this power again is in practice only controlled by his own view of the interests of truth.' (Judgment in *Kennedy* v. *Broun*, 1862.) Thus it will be seen that almost unlimited powers of interrogation are intrusted to counsel by the law, and it is a serious question whether the unrestricted use of these enormous powers is necessary to the administration of justice. One of the most severe reprimands on this abuse came from the same judge in a case which was before him in 1857; and was to this effect: A question had been put throwing on the witness an imputation for which there was really no foundation. The judge then said: 'The freedom of question allowed to the bar was a public nuisance, and the barrister who made such an imputation ought to be prosecuted. If a question had relation to the truth, he was most anxious it should be put, but to cast haphazard imputations at the suggestion of a person (an attorney) who might have no scruples as to what he did, was a degree of mischief that made him wish that a party should be prosecuted. He begged leave to say that in his experience he had seen counsel so abuse their privilege, that he had cordially wished a power could be instituted that they might be prosecuted for a misdemeanour.'

Some medical men have claimed a privilege not to answer certain questions which are put to them, on the ground that the matters have come to their knowledge through private and confidential communications with their patients. It is right to state at once that the law concedes no special privilege of this nature to members of the medical profession. No man is bound to reply to any question if the answer would tend in any way to incriminate himself—for no man is compelled to be a witness against himself. With this exception all questions must be answered, provided they are relevant to the case, and their relevancy is a matter for the consideration of the judge.

Sometimes a witness makes a frivolous objection and refuses to answer an ordinary question, thus bringing only ridicule upon himself. A skilled expert, at an important trial, was asked his age. Instead of answering so simple a question at once, he angrily appealed to the judge to know whether he was bound to give an answer on a matter which, as he said, could have nothing to do with the case. The judge informed him that unless he had some very strong reasons for concealing it, he had better state it. At a trial for murder by poison, in the course of a cross-examination, counsel for the prisoner asked the medical witness what remedy or antidote he had employed when he was first called to attend the deceased. He appealed to the judge to know whether he was bound to answer such a question as that. Judge: 'Yes, unless you have reason to believe that your antidote killed the deceased. In that case you are not bound to answer it!' The question was immediately answered.

As there is no special privilege granted to members of the profession, a witness must remember that there are *no medical secrets.* In the case of the *Duchess of Kingston* this privilege of withholding statements was claimed by a medical witness, but rejected. In the case in which a woman was indicted for the murder of her infant, a surgeon was called to prove certain confessions made to him by her during his attendance on her. He objected, on the ground that he was then attending her as a private patient. Park, J., said this was not a sufficient reason to prevent a disclosure for the purpose of justice, and he was ordered to answer the questions. Any statements, therefore, which are made to physicians or surgeons while attending persons in a private capacity, although they are not to be volunteered in evidence, must be given in answer to questions, whatever consequences may ensue. Cases of poisoning, wounding, and child-murder, as well as cases which involve questions of life-insurance, divorce, or the legitimacy of offspring, may be materially affected by the answers of a medical man on matters which have been the subject of private communications. A professional man who claims a privilege where none is allowed, is simply endeavouring to set himself above the law. It is absurd to suppose that there is any real breach of confidence under these circumstances, because, as Gordon Smith justly observes, 'Society in general receives the authority of courts as paramount to all obstacles and private considerations,' so that in yielding to such an authority, a professional man will be fully acquitted even in the opinion of those who may be the sufferers by his evidence. The expressed opinion of the judge will be a full indemnity for the witness. ('Analysis of Med. Evid.,' p. 98.) Any medical man, however, who voluntarily violated the confidence reposed in him by a patient, or who communicated professional secrets to counsel apart from a public necessity in court, would justly lay himself open to censure.

In *Wright* v. *Wilkin* (June, 1865), a suit involving the validity of the will of a lady, the only question before Kindersley, V.-C., was as to the costs, occasioned by the refusal of a medical witness to answer a question in reference to the disease of which the testatrix had died. The witness had attended the testatrix, and on being asked of what disease she had died, he refused to answer, on the ground of professional privilege and also that the question was irrelevant. The Vice-Chancellor said, that he could not possibly see the relevancy of the question, and, further, of what use it was to examine witnesses at all in the cause. No reason was given for so doing. The question of costs would, *primâ facie*, have been left till the hearing but that it was a dangerous precedent to allow a witness to decline answering on such grounds. He was clearly of opinion that the witness could not claim professional confidence or irrelevancy, as an excuse for not answering the question, and he must pay the costs. From this judgment it will be perceived that even the refusing to answer an irrelevant question may lead to the infliction of a heavy penalty on a medical practitioner. A man who refuses to answer a question which the court considers to be relevant and proper, may render himself liable to imprisonment for contempt. In a case in the Divorce Court (*Babbage* v. *Babbage*, 1875), the wife had petitioned and obtained a decree *nisi* for a dissolution of marriage on account of her husband's adultery. Subsequently to this she wrote a letter to her medical attendant, admitting that she herself had been guilty of adultery. He, when called as a witness, declined to produce the letter or state its contents on account of professional confidence. The judge said he knew of no such privilege as that claimed by the witness. In a court of justice he was bound to produce or state the contents of the letter. See also a case by Braxton Hicks. ('Lancet,' 1885, ii. p. 285.)

The question of medical privilege has presented itself on some occasions in a medico-ethical aspect, as where, for instance, during his attendance on a patient, a suspicion arises in the mind of a medical man that the person is undergoing slow poisoning. It has been supposed that when, under these circumstances, the poisoner was himself in the medical profession, there would be a breach of etiquette in communicating to others the suspicion entertained. There is no code of medical etiquette by which any member of the profession is bound to conceal the fact of poisoning which he believes to be going on before his eyes, whether perpetrated by a medical man or any other person; and at the same time there is a higher code of ethics which makes the prevention of secret murder and the safety of society paramount to all other considerations.

A medical man must take care not to charge another with a crime upon loose suspicion. If, from the nature of the symptoms, the absence of any natural cause for the illness, and the inefficiency of ordinary remedies, he suspects that the patient is under the influence of poison, it is his duty to lose no time in confirming or removing that suspicion by a proper medical and chemical investigation. If his suspicion is confirmed by the discovery of poison in the food or urine, then steps must be immediately taken to save the life of the patient. In *Reg.* v. *Wooler* (Durham Wint. Ass., 1855), in which the prisoner was charged with the murder of his wife by secretly administering to her arsenic, three medical men were in attendance. There was a suspicion that arsenic was being administered to the deceased nineteen days before her death; but the fact was not made known because these gentlemen were unable to satisfy themselves conclusively that arsenic was present in the urine. They appealed to high authority to aid them, but the advice reached them too late,—the patient had died, and, as it was clearly proved, from the effects of arsenic. The judge who tried this case said, 'When the idea of poisoning struck them they ought to have communicated their suspicion to the husband if they did not suspect him, and if they did suspect him they ought to have gone before a magistrate, and not have gone on from the 8th to the 27th June seeing the woman murdered before their eyes.' Christison, in commenting upon this case, very properly takes exception to this advice, and any man acting upon it would expose himself to an action for slander. 'Ideas' of poisoning often arise in cases of disease where the symptoms deviate a little from the ordinary course, but they are dismissed on further observation. If, in the absence of the means or knowledge of applying chemical tests, or of taking the opinion of others experienced in toxicology, a medical man charged the husband of a woman with secret poisoning, or went before a magistrate and charged him publicly, he would be acting with rashness, ruin his own practice and reputation, and be mulcted in heavy damages for the irreparable injury done by a false accusation. Such a step should be taken upon something more than a suspicion. A prudent and conscientious man will always await the result of a chemical analysis before giving publicity to a suspicion which may after all turn out to be quite unfounded; and he will lose no time in obtaining this necessary confirmation or a removal of his doubts.

When the suspicion is confirmed, there is some difference of opinion as to the course to be pursued. Christison advises that when a medical man is satisfied of the fact of poisoning, he should communicate his conviction to the patient himself, and that he ought not to be deterred by the chance of injury to his patient from making even so dreadful a disclosure. He will have thus taken the surest preparative step to prevent a repetition of the poisoning. Whether this communication be made to the patient or not, the proper course will be to place the matter immediately in the hands of a magistrate for investigation. The author was consulted in a case of supposed slow poisoning. The symptoms suffered by a lady, taken as a whole, were not reconcilable with any disease. The medical man had an 'idea' that poison might possibly be the cause, but before acting upon this idea he sent to the author a portion of urine for examination. Antimony was found in it, and the cause of the symptoms was at once explained. The medical attendant communicated the result of the analysis to the members of the family, and the symptoms of poisoning ceased from that time. In one instance within the editor's knowledge, the suspicion of poisoning was communicated to the husband of the patient. He at once committed suicide; and chemical analysis proved the secret administration of arsenic. In another case, strychnine was found in some cocoa of which a lady had partaken. The fact was communicated by the medical attendant to a magistrate; and thus the medical man was relieved of further responsibility. In a third case a woman was seen by three medical men in consultation; and two of them were of opinion that she was being slowly poisoned by antimony. The third was of a contrary opinion. Some urine from the patient was forthwith sent for analysis. No antimony was found; and the patient died very shortly afterwards from cancer of the abdominal viscera. Each case must be treated on its own merits. The error committed by medical men is on these occasions, not in claiming a privilege of concealment, but in allowing a doubt upon so serious a question to remain in their minds for days or weeks.

This question was brought into prominence at the trial of *Dr. Pritchard* at Edinburgh (July, 1865), on the charge of poisoning his wife with antimony. One of the medical witnesses, who saw the deceased a fortnight before her death, and at other times, stated in his evidence at the trial that he suspected she was suffering from the effects of antimony when he first saw her, but it seems that there the matter was allowed to remain. No one was accused, but no step was taken to prevent the continuance of the poisoning, the suspicion of which turned out to be well-founded. Lord Justice Clerk, who tried this case, is reported to have said that no notions of medical etiquette should be permitted to interfere with those higher duties which every right-minded man owes to his neighbour, and which are to be expected in a tenfold degree from every medical man, because his life is solemnly devoted to the preservation of life and the prevention of its destruction.

Examination-in-chief.—The ordinary course of proceeding in a criminal case is thus concisely stated by Stephen, J. After opening the case, the counsel for the Crown calls the witnesses, and examines them according to the rules of evidence—that is, he brings out, by questions *which do not suggest their answers*, the facts relevant to the issue to be tried which are within his personal knowledge. Those questions which do suggest the answers, are called 'leading' questions. With one exception it is not the practice to allow these to be put in this part of the examination. The exception is: 'When the judge is satisfied, either by a witness's demeanour or by contradictions between the evidence and the depositions, that he is trying to keep back the truth and favour the prisoner, he may, in his discretion, allow the counsel for the Crown to ask leading questions and, as the phrase is, to treat the witness as hostile.' When the examination-in-chief is closed, the next step is the cross-examination.

Cross-examination.—In this, the second stage, the counsel for the prisoner extracts from the medical witness, by questions *which may suggest the answers in the strongest form*, any facts that may appear to be favourable to his client, and which he believes to be within the witness's knowledge. Leading questions are not only allowable in this part of the examination, but, according to good authority, a counsel for the defence can hardly lead too much. The theory of the law is that the witness is unfavourable to the prisoner and has come to bear evidence against him. The more he has shown himself by conduct or conversation a partisan in the case, the more severely will he be treated. Anything which he may have said in the hearing of others, or published in journals, or even written in private letters (if the contents transpire), in reference to the case, or the guilt of the prisoner, is now brought to light, although he may have supposed that what he did say was in perfect confidence. It is at this stage of the case that any exaggerations which may have been most favourably received by the counsel for the prosecution, are reduced to their true proportions. Any bias by which the mind of a witness may have been influenced, or any imperfection or confusion of memory as to facts, is here brought out. It is in this part of his examination that a witness will be closely questioned as to his qualifications, his age, the time during which he has been engaged in practice, the accuracy of his judgment, his general professional knowledge, and his special experience in reference to the matter in issue, the number of cases he has seen, &c. Straightforward answers should be given to all these questions. No harm can be done to the witness by the answers unless they are given evasively, since it is not to be supposed that a witness wishes to represent himself differently from what he is. If he does make the attempt he will assuredly fail. The most striking distinction between the examination-in-chief and cross-examination is in reference to leading questions. It rests upon the assumption that there is a danger that a witness will say whatever is suggested to him by the one side, and conceal everything that is not extorted from him on the other. It need scarcely be observed that witnesses whose evidence is of little importance in the case, are rarely cross-examined. This is reserved in its most stringent form for those whose facts and opinions are likely to affect the fate of a prisoner on a criminal trial. In dealing with a skilled witness whose evidence may be of importance, the questions in cross-examination are usually put by the council for the prisoner with great caution, or the answers brought out may be even more adverse to his own case than those elicited in the examination-in-chief.

Re-examination.—The cross-examination is usually followed by a re-examination on the part of the counsel for the Crown, or of the counsel by whom the witness has been called. The object of this is to clear up or explain any portion of the evidence which may have been rendered obscure or doubtful by the cross-examination. It is sometimes unnecessary to put a question, and if the witness has given his evidence consistently and fairly no questions may be asked. As a rule the re-examination must be confined to those matters which have arisen out of the cross-examination. Any questions upon new subjects may render a further cross-examination on them necessary. In reference to *facts*, a medical witness must bear in mind that he should not allow his testimony to be influenced by the consequences which may follow from his statement of them, or their probable effect on any case which is under trial. In reference to *opinions*, their possible influence on the fate of a prisoner should inspire caution in forming them, but when once formed, they should be honestly and candidly stated without regard to consequences. It will be well to remember, in reference to each stage of the examination, what William Hunter had said:—'To make a show and appear learned and ingenious in natural knowledge may flatter vanity. To know facts, to separate them from supposition, to arrange and connect them, to make them plain to ordinary capacities, and above all to point out their useful applications, should be the chief object of ambition.'

Quotations from Books.—It is a not unfrequent custom with counsel to refer to medical works during the examination of a witness. He is expected to have a fair knowledge of the writings of professional men on the subject of inquiry. The authority is mentioned, the passage is quoted, and the witness may be then asked whether he agrees with the views of the author or whether he differs; and if so, his reasons. In cases connected with medical treatment, the views of the profession are and have been so various, that a barrister would have no great difficulty in finding some book to oppose to the opinions of a witness. Standard works of recent date are so well known to the profession, that there are few medical men engaged in practice who are not well acquainted with and able to explain the views of the writers, and how far they agree or conflict with his own. The witness must be on his guard that the quotation is fairly made, and that it is properly taken with the context, or he may unexpectedly find himself involved in a difficulty. On one occasion a barrister stopped in his quotation at a comma, and on another occasion the quotation ended at a colon, the remainder of the sentence in each case materially weakening the inference which it was intended to draw with the apparent sanction of the witness.

When a quotation from a standard work is thus opposed to the evidence of a medical witness, he should ask to look at the book, and see by reference to the work itself that the passage is correctly quoted. A remarkable instance of the importance of this caution occurred at the Swansea Lent Ass., 1869, in an action brought against a railway company for compensation for personal injury. The plaintiff was proved to have had pneumonia shortly after the accident, and the counsel for the company wished to show that the pneumonia had not arisen from the physical injury. In cross-examining the medical witness he asked, 'Cannot pneumonia be produced by shock?' *Witness:* 'I do not believe it to be possible.' *Counsel:* 'What! do you mean to say you do not believe what is asserted in fact by no less an authority than Professor Taylor? Have you read Dr. Taylor's work on "Medical Jurisprudence"?' *Witness:* 'Yes.' *Counsel:* 'Have you seen the last edition?' *Witness:* 'No.' *Council:* 'I have it here (turning over the leaves of a book), and a case is given of pneumonia being caused by shock.' It was subsequently discovered, on referring to the work, that the case in question was one in which the lung had been wounded by a fractured rib. The cause of the pneumonia was thus sufficiently explained; it was proved to have been the simple result of physical injury and not of shock. A reference at the time to the work which is quoted, is always necessary if any use is to be made of a quotation. Without suggesting that there is intentional misrepresentation to bear out a particular view of the case, a barrister in dealing with the medical facts may wholly misunderstand the author's views and statements, and in some instances wrongly assign to the author himself opinions which he has merely quoted from other authorities for comment or illustration.

As a rule, the works of a living author cannot be quoted, it being a legal maxim that secondary evidence is only admissible when primary evidence can be obtained: hence, as a living author can be called as a witness, his works cannot be quoted in evidence. (*Reg.* v. *Lamson*, C. C. C., March, 1882.)

Presence in Court.—In England medical and scientific witnesses, except under special circumstances, are allowed to be present in court, and hear the whole of the evidence of the case. This is in some instances absolutely necessary if the court requires medical opinions, for unless the witnesses are fully acquainted with the facts they can give no opinions, and they can only become well acquainted with the facts by being allowed to be present and hearing the evidence in court. If excluded, the judge or counsel will be compelled to read to the witness notes of the evidence before an opinion can be given, and it may then appear that some small point which counsel did not think of importance, has been omitted: this, if known to the witness, might, however, materially affect his opinion. A failure of justice is likely to occur when medical witnesses are excluded, and it is generally when there is no defence or a false defence that the right of excluding them is exercised. The rule in Scotland is similar; medical and scientific witnesses are allowed to be in court during the trial.

The examination of the witnesses for the Crown is followed by the defence of the prisoner, either in person or by his counsel who acts throughout the part of an advocate, simply securing for his client every advantage the facts or the law may afford him. In other words, he sees that his client is tried strictly according to law, and not condemned contrary to law. A key to some of the difficulties which medical witnesses must be prepared to encounter will be found in the exposition given by Stephen, J., of the tacit rules which regulate the duties of counsel for the prosecution and defence:—'In practice it is universally admitted that the counsel for the prosecution is morally and professionally bound always to keep in sight the ultimate object—namely, the discovery of truth; whereas no such obligation is laid upon the prisoner and those who represent him, because it is too much to expect of human nature that they should discharge it, and it is better not to impose an obligation which is sure to be systematically violated. Both sides, on the other hand, are bound in the strongest way *not to do anything to propagate falsehood.* The counsel for the Crown is bound not to suppress any fact within his knowledge favourable to the prisoner; and, on the other hand, the counsel for the prisoner is bound not to bring to light facts within his knowledge unfavourable to the prisoner. 'The counsel for the Crown may not use arguments to prove the guilt of the prisoner which he does not himself believe to be just, and he is bound to warn the jury of objections which may diminish the weight of his arguments: in short, as far as regards the evidence which he brings forward, his speech should as much as possible resemble the summing-up of the judge. He should contend not for the success of his cause at all events, but for the full recognition by the judge and jury of that side of the truth which makes in favour of it. On the other hand, the counsel for the prisoner may use arguments which he *does not believe to be just.* It is the business of the jury, after hearing the judge, to say whether they are or are not just.' The last remark shows what appears to be a serious defect in the administration of the criminal law. While in a case of misdemeanour a prisoner may be tried by a special jury, in a case of felony, involving an analysis of important questions of medical science in reference to murder or manslaughter, the trial takes place before a common and comparatively ignorant jury. Such a jury is hardly in a position to cope with an ingenious counsel, who has it in his power to misrepresent and distort medical facts and opinions in any manner that he pleases. The defences made are frequently such as no barrister would venture to place before a jury of educated men.

Another observation made by Stephen, J., more nearly concerns the medical witness:—'There are many obligations which affect each side equally. Neither is at liberty to attempt to browbeat, intimidate, or confuse a witness, although they may expose any real confusion which exists in his mind, or test, by the strictest cross-examination, the accuracy of his statements. Neither is at liberty wilfully to misunderstand a witness, or to *misstate, in his address to the jury*, the effect of what he has said, either by distortion or suppression. The neglect or observation of these and other rules of the same kind practically establishes a wide distinction, and one which is easily recognized, between those who exercise a noble profession and those who disgrace it.'

Assuming that a medical witness is properly prepared for the discharge of his duties, and that the questions put to him are answered fairly and truly, according to his knowledge and experience, without exaggeration or concealment, he has no reason to fear any attempt at intimidation.

The normal barrister, as depicted by Stephen, J., is not at liberty, in his address to the jury, to misrepresent, either by distortion or suppression, the medical facts or opinions given in a case. According to our experience, however, misrepresentation is a not unfrequent practice, and one of which medical witnesses have very strong reason to complain. Whether such misstatements are wilful or not it may be difficult to determine, but their effect on the jury is well known to those who employ them, and they frequently escape the observation of the counsel on the other side, and even of the judge, unless he is well versed in medical subjects.

Intimidation is sometimes carried very far. On a trial for murder by poisoning, a respectable country practitioner, who had given his evidence for the Crown in a fair and proper manner, was thus addressed in cross-examination by a learned counsel now deceased:—'On your oath, sir, and in the face of the whole profession, will you venture to persist in that statement?' &c. A writer, in commenting upon this subject, says, 'But the hardest and most unfair part of the system (of cross-examination) is when witnesses have to bear a loud and insulting tone or gesture without remonstration or retaliation.' At the trial of Kelly for the murder of Police-constable Talbot (*Reg.* v. *Kelly*, Dublin Commis. Court, Nov. 1871), Tuffnell, a surgeon of repute, and formerly Professor of Surgery, was summoned as a witness for the prosecution. Having deposed to the nature of the wounds, and that the deceased had died from the effects, he was subjected to the usual ordeal of a cross-examination, but in a somewhat unusual form. Counsel for prisoner having begun by addressing him in a loud and offensive tone, he turned to the Chief Baron, and said, 'My Lord, I am very excitable, and if this gentleman has a right to roar at me, I consider that I have a right to roar too.' The Court expressed a hope that it would not be necessary for him to roar, and intimated, after a short trial of vocal strength between the two opponents, that counsel's manner to the witness was not what it ought to be. Counsel disclaimed any intention of being offensive, but claimed the liberty which is usually conceded in cases of importance. Whatever may be the importance of a case to a prisoner, nothing can justify the putting of questions in a loud and insulting tone to a skilled professional witness. The very mild rebuke administered to counsel on this occasion was not likely to produce much effect, and accordingly this trial presents, in a concentrated form, all the defects of our method of getting at truth by cross-examination. The result is seen in the unsatisfactory nature of the verdict, which was against the medical and general evidence in the case.

Rules for the delivery of Evidence.—There are a few rules bearing upon medical evidence which, if observed, may save the witness from interruption or reproof, and place him in a favourable position with the court:—

1. The questions put on either side should receive *direct* answers, and the manner of the witness should not be perceptibly different, whether he is replying to a question put by the counsel for the prosecution or for the defence. Most of the questions put by counsel in cross-examination will admit of an answer 'yes' or 'no.' If, from the ingenious or casuistical mode in which the question is framed, the witness should feel that the simple affirmative or negative might mislead the court, then, after giving the answer, he can appeal to the judge to allow him to qualify it, or add to it any matter within *his own knowledge* and which is at the same time relevant to the case. The witness must remember that he takes an oath to state the truth, *the whole*

truth, and nothing but the truth. On the other hand, while the counsel for the defence is bound not to introduce falsehood, his object is *not* the discovery or development of truth. Unless the witness is on his guard, he may find that his affirmatives and negatives may be worked into a shape representing the reverse of what he intended.

Some counsel adopt the ingenious plan of compressing two or three questions into one; or they submit a series of questions, more than one of which may contain two opposite alternatives, and then ask for a plain answer 'yes' or 'no' to both of them together. A witness may unthinkingly answer that question which has most fixed his attention. The same answer may not be strictly applicable to all, but it may be found, when too late, that it is made so in the defence. Under these circumstances he should ask for a severance of the questions and give separate replies. Direct answers are necessary, because it is only by them that the case can be brought clearly before the court and jury in all its details. Medical witnesses sometimes forget this, and fall into answers to questions floating in their own minds, or which they think are likely to be put to them. They are also sometimes disposed to anticipate many questions by one general answer. This simply creates confusion, and the witness will be told by counsel to keep to the question, and that he is coming to the other matters presently. Care should be taken by a medical witness not to argue with counsel. Argument is not evidence, and the entering into it disturbs the order of the proceedings. Arguments between counsel and witnesses, and even between medical witnesses themselves, are not allowed. The mode in which questions are put by counsel in cross-examination sometimes tends to the introduction of argument, but the witness should avoid the temptation to enter into it. What he says under such circumstances is not evidence, except in the form of answers to questions, and he is there only for the purpose of stating what is relevant to the case.

2. The replies should be concise, distinct, and audible; and, except where explanation may be necessary, they should be confined strictly to the terms of the questions. The judge who tries the case, generally takes full notes of the medical evidence—hence the necessity for a slow and distinct delivery of the evidence. Some witnesses have a habit of not answering the question which is asked, but one which is not asked. Others give an answer in such a voluble form that there is great difficulty in reducing it to its proper proportions. A witness who is so profuse of information generally supplies abundant matter for a long and troublesome cross-examination. It has been a question whether a witness should volunteer evidence, assuming that the examination-in-chief and cross-examination have failed to bring out all that he knows of the case. If that which he has to state is some matter of fact within his own knowledge, or an opinion based on facts within his knowledge, he will be allowed, on application to the judge, to make the statement in spite of the efforts of counsel on either side to shut it out.

It is scarcely necessary to observe, that the language in which the answers are returned should neither be technical nor metaphorical.

Counsel who are unacquainted with medical terms frequently misapply them, or use them in a wrong sense. On a trial for murder, in which one of the questions at issue was whether dysentery or poison was the cause of death, the counsel puzzled one of the medical witnesses by asking him whether during his attendance he found any traces of '*dysuria*' in the fæces. There is no doubt he intended a state of the fæces like that met with in dysentery, but the professional term employed by him signified a 'difficulty in passing urine'! A judicious witness will avoid anything like a triumph over his examiner under such circumstances, and simply put him right.

3. Answers to questions should be neither ambiguous, undecided, nor evasive. An ambiguous answer necessarily leaves the witness's meaning doubtful, and calls for an explanation. An undecided answer is not sufficient for evidence. Did the wound cause death? Was death caused by loss of blood, or by poison? If, by a proper consideration of all the medical facts, the witness has come to a conclusion on the subject, his answer should be expressed in plain and decided language, either in the affirmative or negative. A man who has formed no conclusion is not in a position to give evidence. No opinion should be given for which the witness is not prepared to assign reasons, and, except by permission of the court, no medical opinion should be expressed on facts or circumstances observed by others. A hesitating witness will be met with the question, Have you any doubt about it? or, Was it so, or not?—to which a reply in the affirmative or negative must be given. If the witness fairly entertains doubts about the matter at issue, it is his duty to express them, and not allow them to be extorted from him piecemeal by a series of questions.

Chemical witnesses have occasionally certified to the discovery of 'imperceptible,' 'unmistakable,' or 'undoubted' traces of poison in the liver, &c. Such terms naturally convey to the shrewd mind of an examiner that the witness has some lurking doubt or suspicion of mistake in his mind, for that of which we are sure requires no such terms to express our meaning. If poison has been discovered, the statement of the fact is sufficient.

4. The replies should be made in simple language, free from technicalities and exaggeration. Some remarks have been elsewhere made in reference to the use of technical terms in drawing up medico-legal reports (p. 14). If medical men could be made aware of the ridicule which they thus bring on their evidence, otherwise good, they would at once try to dispense with such language. A witness is perhaps unconsciously led to speak as if he were addressing a medical assembly, instead of plain men like the members of a common jury, who are wholly ignorant of the meaning of medical terms, and barristers who are but imperfectly acquainted with them. A court may be told that the '*integuments* were *reflected* from the thorax, and the *costal* cartilages laid bare, when a wound was found which had penetrated through the anterior *mediastinum*,' and had involved the arch of the aorta, &c. A simple cut in the skin is described as 'an incision in the integuments.' In a case of alleged child-murder, a medical witness being

asked for a plain opinion of the cause of death, said that it was owing 'to atelectasis and a general engorgement of the pulmonary tissue.' On a trial for an assault, a surgeon, in giving his evidence, informed the court that on examining the prosecutor, he found him suffering from a severe contusion of the integuments under the left orbit, with great extravasation of blood and ecchymosis in the surrounding cellular tissue, which was in a tumefied state. There was also considerable abrasion of the cuticle. '*Judge:* You mean, I suppose, that the man had a bad black eye? *Witness:* Yes. *Judge:* Then why not say so at once?' It would be easy to multiply examples of this kind. This is not science but pedantry, and if such language is employed by a witness with a view of impressing the court with some idea of his learning, it wholly fails of its effect. Barristers and reporters put down their pens in despair, and the time of the court is wasted until the witness has condescended to translate his ideas into ordinary language. Lord Hatherley well observed that 'a scientific witness in giving his evidence should avoid as much as possible the use of technical scientific language, if the case is before a jury. This is especially desirable when the evidence is medical, for really many technical words in medicine seem to be invented to cover ignorance. But be this as it may, a witness is always suspected of affectation, and the court and jury are but little instructed when a vast amount of learned phraseology is poured forth instead of a clear statement of the witness's opinion.'

Exaggerated language should be avoided. There is a tendency among some medical witnesses to express their own views in the superlative degree. If a part is simply inflamed, it is frequently described as 'intensely' inflamed. This use of exaggerated language often leads to apparent conflict in medical testimony. It is not creditable to the witness, and throws a doubt upon the whole of his evidence.

5. In giving evidence of *opinion* a medical witness must take care not to base it on any statements made by others, or on circumstances which may have come to his knowledge by public rumour. Again, his evidence should be confined only to subjects properly within the range of medical science, and on which, as a professional man, he is competent to speak. In a trial for murder by wounding, in which the identity of the prisoner was in question, a medical man stated that he compared certain footmarks with the boots taken from the prisoner, and he found that they corresponded. A comparison had also been made, but not at the same time, by a police-officer, more accustomed to matters of this kind. On cross-examination, there was such a want of agreement between the surgeon and the constable, respecting the number of nails in the boots and the number indicated by the footprints, that no reliance could be placed on this portion of the evidence. In reference to this discrepancy, the learned judge remarked that a medical man should confine himself to matters belonging to his own profession, and not take upon himself the duties of a police-constable. There are some points in reference to gunshot wounds which can be better explained by a gun or shot-manufacturer than by a medical witness.—*Cuique in suâ arte credendum.*

Fees.—The following information as to fees payable to medical witnesses may be useful to the medical practitioner :—

In the Supreme Court of Judicature, and in the Court of Appeal, £1 1*s.* a day if resident in the city where the case is tried ; and £2 2*s.* to £3 3*s.* a day if resident at a distance from the place of trial, inclusive of all except travelling expenses. For travelling expenses a sum not exceeding 3*d.* per mile each way if there be a railway, and 6*d.* per mile each way if there be no railway. It is customary to pay return first-class, or sometimes second-class, railway fare only. In the Divorce Court, £1 1*s.* a day if resident within five miles of the General Post Office. Higher charges are allowed for experts. Sundays are never counted. In the County Court, 10*s.* to £1 1*s.* a day is allowed. At Assizes, medical men attending to give professional evidence are usually allowed £1 1*s.* a day, 2*s.* for every night they are away from home, and second-class travelling expenses by rail, or a sum not exceeding 3*d.* a mile each way when there is no railway.

Every registered medical practitioner is entitled, if formally summoned, to a fee of £1 1*s.* for attending to give evidence at a coroner's inquest, where no *post-mortem* examination is ordered, and to an additional fee of £1 1*s.*—£2 2*s.* in all—when an examination is ordered. The fee for a *post-mortem* examination will not be paid if the examination has not been ordered in writing. These fees are to be paid by the coroner immediately after the close of the inquest. There is no provision for a second attendance at an adjourned inquest, nor for making a second *post-mortem* examination. Some coroners are in the habit of paying £1 1*s.* for each day's attendance. Others pay £1 1*s.* only for all the attendances, however many. No unregistered medical practitioner, whatever his diplomas may be, can claim fees for giving medical evidence. In all cases where attendance is required in a civil court to give expert evidence, a special agreement should be made in writing, binding the solicitor who requires the attendance to himself pay the fees, as these are only recoverable from principals, unless there is a special agreement to the contrary.

The fee for attendance in a Police Court is 10*s.* 6*d.*, or £1 1*s.* if more than two miles distant.

CHAPTER 3.

CAUSES OF DEATH.—SUDDEN DEATH.—SYNCOPE, ASPHYXIA, COMA.—SIGNS OF DEATH.—CESSATION OF CIRCULATION AND RESPIRATION.—COOLING OF THE BODY.—CADAVERIC RIGIDITY.—PUTREFACTION.—CHANGES PRODUCED IN THE BODY.—PUTREFACTION MISTAKEN FOR GANGRENE.

MEDICAL jurisprudence takes cognisance of all violent causes of death, and is only indirectly involved in those cases of natural death which simulate the effects of violence. Thus all causes which operate to produce death suddenly, especially demand the attention of a medical jurist. These may be either natural or violent; and the distinction between them is of importance, since the guilt or innocence of a person charged with crime may depend on a correct determination of the cause.

The continuance of life depends upon the proper and regulated action of the heart, the lungs, and the brain; and the interdependence of these organs is such that the arrest of the functions of one of them, is speedily followed by the arrest of the functions of the others. Hence they have been called the tripod of life. When the suspension of the motions of the heart is the primary cause of death, the person is said to die by syncope. The term asphyxia is applied to death which begins by the lungs; and coma to that which arises from a primary disturbance of the functions of the brain.

Syncope (συγκόπτω, signifying to strike down).—In order that the action of the heart should be maintained, it is necessary, first, that the blood supplied to it should be in sufficient quantity, and secondly, that this blood should be of proper quality. In death from hæmorrhage we have an instance of deficiency, and in death from certain poisons as well as diseases, an illustration of defect of blood (asthenia). In ordinary syncope (fainting or swooning) there is simply a deficiency in the quantity of blood which passes through the heart, although there is no actual loss of this fluid from the circulation. Certain diseases which affect the muscular structure of the heart, as well as its membranous valves and blood-vessels, may also lead to a sudden arrest of its functions. These morbid conditions produce a mechanical impediment to the motions of the organ by which the blood is propelled, and death by syncope is the necessary result. One of the most striking of the phenomena which attend this mode of dying (death from hæmorrhage or anæmia), is an extreme pallor of the face, hands, and lips, and indeed of the body generally. The patient is very restless, tossing the limb about in all directions. Giddiness and nausea are often complained of, and actual vomiting may occur. In many cases vision is extinguished, everything appearing black. There is transient delirium, which soon passes into insensibility. The pulse becomes more and more weak and irregular, until at length it is imperceptible. The respiratory movements are repeated at uncertain intervals, and have a sighing, or gasping character. Towards the last there are general convulsions (Fagge on the 'Different Modes of Dying,' 'Guy's Hosp. Rep.,' 1879, p. 343). In these cases the heart is found empty and contracted at the autopsy. When, however, from any cause, there is sudden stoppage of the heart, the right and left cavities of this organ are found to contain blood in the normal proportion in which that fluid is ordinarily circulated. Blood is found in the large veins (venæ cavæ) as well as in the arterial trunks. There is no congestion or accumulation of blood in the lungs or brain.

Asphyxia (ἀ priv. and σφύξις pulse, signifying pulselessness).—This state is induced by any cause which arrests the function of respiration. The term apnœa (from ἀ priv. and πνέω, I respire) is less appropriate, and is now applied by physiologists to an exactly opposite condition—that which consists in an excessive supply of oxygen to the blood, rendering respiratory movements for the time unnecessary. The various forms of death by suffocation, as in the obstruction of the air-passages from mechanical causes, in drowning, hanging, and strangulation, furnish illustrations of death commencing by the lungs, or asphyxia. The effect of cutting off air from the lungs is that the blood is not aërated, and it is therefore circulated in a state unfitted to support the nutrition of the heart and brain. It is necessarily distributed with the impurities derived from the waste of tissue, and thus acts as a poison to all the organs. It is incapable of sustaining nerve-force or muscular irritability. It stagnates in the capillary vessels of the lungs, produces a languid action of the heart by its circulation through the muscular structure of this organ, and causes insensibility by its distribution through the blood-vessels of the brain. The lungs are essential to the circulation by purifying the blood. Death from asphyxia may be therefore regarded as death from *defect* of blood. The observations of Brodie and others have clearly proved that, in spite of the impurity of the blood, the heart will continue to act and the circulation to be maintained for two or three minutes or longer after breathing has entirely ceased. This may be proved by hanging or strangling an animal, and observing the condition of the heart. As the action of this organ continues after the animal has ceased to breathe, life is not actually extinct; and under favourable circumstances, it may be restored, if no injury be done to the air-cells of the lungs, so long as this action continues. Supposing that the suspension of respiration is complete, the action of the heart gradually slackens and finally stops. It is at this period of the complete arrest of the motions of the heart that asphyxia passes into death. The circulation of the unaërated blood through the brain, appears to annihilate sensibility, so that no consciousness or feeling exists; the person is, to all appearance, dead. There are many diseases which operate fatally by arresting the functions of the lungs; and these may be regarded as furnishing the natural causes of asphyxia. The violent causes, including not only the ordinary modes of suffocation, but the effects of certain poisons, are not difficult to appreciate, provided a true history of the case can be obtained. Michael Foster has shown how, in experiments on animals, it is very soon observed that the expiratory efforts become exaggerated out of all proportion to the inspiratory, and how they quickly pass into convulsions. This period lasts about a minute, during which time the pulse is increased in frequency, and the arterial blood-pressure rises. Deep slow breathing then supervenes, and the inspiratory movements are now more marked than the expiratory, the more yielding parts of the chest wall receding at every inspiration. The cardiac beats decrease in number, but remain forcible, though the arterial pressure falls. The respiratory rhythm becomes irregular, long pauses being followed by quick inspirations with brief intervals. The inspirations next become shallow and gasping, the acceleratory muscles of respiration being brought into active play, and at last the gasps end in a convulsive stretching of the whole body;

and, with extended limbs and a straightened trunk, with the head thrown back, the mouth widely open, the face drawn and the nostrils dilated, the last breath is taken in. There are three distinguishable stages in these phenomena of asphyxia which result from a continued deficiency of air:—1. A stage of dyspnœa, characterized by an increase in the respiratory movements both of inspiration and expiration. 2. A convulsive stage, characterized by the dominance of the expiratory efforts, and culminating in general convulsions. 3. A stage of exhaustion, in which lingering and long-drawn inspirations gradually die out. When brought about by sudden occlusion of the windpipe, these events run through their course in from three to five minutes. The phenomena of slow asphyxia, where the supply of air is gradually diminished, are fundamentally the same, and the same stages are seen, but with their development taking place more slowly than where there is a sudden and total deprivation of air. The heart continues to beat for some seconds after all respiratory movements have ceased, whether the asphyxia be rapidly or slowly developed.

In animals, the cardiac chambers at the moment of death are all gorged with blood—the left ones as well as the right. When rigor mortis sets in, the left auricle and ventricle empty themselves; and in ordinary autopsies in the human subject, the pulmonary artery, the right cavities of the heart, and the venæ cavæ are found gorged with blood. The pulmonary veins, the left cavities of the heart, and the aorta, are either empty or contain but little blood. In certain cases of asphyxia, the right cavities of the heart, as well as the left, have been found empty. When the access of air to the lungs is suddenly and completely cut off, the circulation of the blood is very speedily arrested; but supposing the occlusion of the air-passages to be partial or gradual, the circulation of the blood may continue for a time, and thus cause congestion of certain organs. Hence the appearances in asphyxia differ greatly. A mixed condition under the name of syncopal asphyxia has been described by some pathologists. In this, the cavities of the heart are found empty.

Coma (from τὸ κῶμα, a deep sleep).—Beside a due supply of properly aërated blood, the brain requires for the exercise of its functions a proper quantity of blood, so that either by the sudden withdrawal of this fluid, or by a circulation of impure blood, these are arrested. A person thus affected falls into a state of complete insensibility (coma), so that it is impossible to rouse him. The functions of the heart and lungs are not always suddenly arrested under these circumstances. They appear to be less dependent on the brain than the brain is upon them; but this is rather a question of degree. A due supply of nerve-force is required for the action of the muscles, whether of the heart or of the chest; and when this is withdrawn, the heart ceases to pulsate, and the respiratory muscles cease to act: circulation and respiration are thus arrested by the absence of innervation. This is sometimes described as death by paralysis of the heart and lungs. The blood is neither aërated nor circulated. Sudden death from apoplexy is an illustration of death by the brain. Coma may also be a result of the introduction of certain poisons into the blood, and of fractures of the skull leading to compression of the brain or destruction of its substance. Death beginning at the brain is, indeed, scarcely to be regarded as a mode of dying, since it may usually be resolved into either death from sudden paralysis of the respiratory centre, when death is often absolutely quiet; or the coma ends in asphyxia, when the extinction of respiration is brought about more slowly. In death by the brain, the appearances observed consist chiefly in a congested state of the cerebral membranes and substance of the brain. As, before death, the breathing is affected, the lungs are congested and blood accumulates in the cavities of the heart, more on the right than on the left side.

The appearances described as characteristic of the different modes of death by the heart, lungs, and brain, are liable to variation by reason of the intimate relations of these organs. Thus, there may be a mixed condition of syncope and asphyxia, or of asphyxia with cerebral congestion.

With regard to the interruption of the functions of the brain as a result of pressure by the effusion of blood or serum, it is to be observed that a very small quantity effused at the base or in the substance of the medulla oblongata is sufficient to cause death; while, generally speaking, a larger quantity is required to be effused in the membranes, ventricles, or substance of the brain, in order to produce a fatal result. In cases of chronic hydrocephalus, in which the brain has resisted the pressure of a large accumulation of serum for many years, a slight and sudden increase in the quantity at any period of life may lead to coma and death by apoplexy. This condition may be mistaken for narcotic poisoning.

All causes of death, whether from disease or violence, are referable to an effect produced primarily on the heart, the lungs, or the brain; but, as it has been elsewhere stated, death does not take place until the action of the heart has entirely ceased. The arrest of the circulation produces an immediate impression upon the functions of the brain and lungs; while the lungs and brain are affected and can only affect each other indirectly through the medium of the circulation: hence, systemic death, or the death of the body, is resolvable into death by syncope or a failure of the action of the heart, and this depends in all cases either upon defect or deficiency of blood.

The natural causes of *sudden death* may be generally traced to some injury or impediment to the action of the heart, lungs, or brain. It would be foreign to the objects of this manual to give a description of them. The violent causes are those which demand the especial attention of a medical jurist; they will be considered hereafter. In its relation to medicine and medical jurisprudence the subject of sudden death has been most fully treated by Herrich and Kopp ('Der Plötzliche Tod aus inneren Ursachen,' 1848); by Devergie ('Ann. d'Hyg.,' 1838, 2, 145); and by Fagge ('Guy's Hosp. Rep.,' 1879, p. 343).

The *violent* causes of death, whether sudden or protracted, which chiefly require the skill of a medical jurist for their elucidation, are poisoning, wounds, and personal injuries; such as burns and scalds, as well as those forms of death which commence by the lungs, including drowning, hanging, strangulation, and suffocation. In nearly all cases, the body of the deceased is produced, and a medical opinion can be based upon a careful examination.

Signs or Indications of Death.—The verification of death is occasionally a duty thrown on the medical jurist. Certain signs or indications have been pointed out as proving that death is real, and not apparent. These are taken in the order of their importance.

1. *Cessation of Circulation and Respiration.*—The heart is considered to be the organ in which life begins and ends—the *primum vivens* and *ultimum moriens*—the first to live and the last to die. The proof of death is the proof of the cessation of the heart's action for a certain period. The more visible indication of death is the cessation of breathing, and, in the opinion of Brodie, the entire cessation of breathing alone may be regarded as a decisive test of the extinction of life. The movements of respiration cannot be overlooked by any one who does not choose to overlook them; and the heart never continues to act for more than four or five minutes after respiration has ceased. The proofs of the continued action of this organ are, however, less obvious to the unskilled observer than the movements of the chest: hence the visible cessation of these movements, i.e. of breathing, for a period of five minutes furnishes a certain proof that the person is really dead. But the skilled observer would apply the test of auscultation, and before giving an opinion should satisfy himself of the permanent cessation of the heart's action. It is impossible to admit that the heart can remain for even half an hour in a state of inaction in a human being, and then spontaneously recover its activity.

2. *Cooling of the Body.*—The normal temperature of the interior of the *living* body in health is about 98·4° F. It is liable to be increased in some diseases, and to be diminished in others. In a case of typhoid fever the blood was found to have a temperature of 113° F.; in strychnine poisoning it is very high. The time usually assigned for the cooling of the dead human body is from *fifteen* to *twenty hours*, but it varies according to the condition of the body at the time of death, the mode of death, and the circumstances under which it had been placed. Thus, if exposed naked to a cold atmosphere, the cooling of the body is very rapid. If it is well covered, the cooling takes place slowly. When death has taken place suddenly from accident, apoplexy, or acute disease, the body has been observed to retain its heat for a long period. Obviously, a dead body cools less rapidly as its temperature approaches that of the surrounding medium. Goodhart found the average rate of cooling during the first three hours after death to be at the rate of about 4° F. per hour, during the next six hours the rate was 3° per hour; and, at later periods, rather more than 1° per hour.

3. *Cadaveric Rigidity. Rigor Mortis.*—In from five to six hours

after death, and generally while the body is in the act of cooling, the muscles of the limbs are observed to become hard and contracted in the attitude in which the body is placed; the joints are stiff, and the trunk firm and unyielding. This peculiar condition is known under the name of cadaveric rigidity, or rigor mortis. The first effect of death from any cause is in most cases a general relaxation of the whole of the muscular system. The lower jaw drops, the eyelids lose their tension, the limbs are soft and flabby, and the joints are flexible. The muscular tissue may be considered as passing through three stages in a dead body. 1. It is, at first, flaccid, but contractile; although it may be remarked that muscles contracted by living force in the act of dying, do not necessarily become relaxed in death. 2. It becomes rigid and incapable of contraction. 3. It is once more relaxed, and does not regain its power and contractility. The body now passes into the stage of incipient putrefaction. The first stage defines the duration of muscular irritability; the second stage, that of cadaveric rigidity; and the third, that of the commencement of chemical changes, or putrefaction.

At a certain period after death, the heart is found rigid and firmly contracted. If examined at this time, it may appear to be in a state of spasm, and to have its walls thickened, while the cavity of the left ventricle may be described as being much smaller than in the normal state. Paget has pointed out that this natural condition of the heart after death has led to pathological mistakes, the walls being described as thickened, the cavities diminished in size, and the heart itself as being in a state of concentric hypertrophy from disease. On the other hand, the perfect relaxation of the heart which follows at a later period after death has been mistaken for, and described as, a morbid flabbiness and flaccidity. Spasm and paralysis cannot be inferred to have existed when we discover these conditions of the heart in the recently dead body.

Under the action of poisons like strychnine and those alkaloids which cause death by convulsions, the more violent and frequent the convulsions, the sooner rigidity sets in. Whatever exhausts muscular irritability before death, appears to accelerate rigor mortis in the muscles after death. In those instances in which muscular irritability at the time of death is slight, either in consequence of a bad state of nutrition or of exhaustion from over-exertion, or from convulsions caused by disease or poison, it is observed that rigidity sets in and ceases soon, and putrefaction appears and progresses quickly. (Brown-Séquard, 'Proc. Roy. Soc.,' 1861, p. 204). For a similar reason it takes place at an earlier period in the very young and in the old, than in an adult in the prime of life.

If we allow a proper interval to elapse after the supposed death of a person, there can be no difficulty in solving the question whether the body is really dead even before any of those changes which arise from putrefaction have manifested themselves. The circumstances on which we may rely as furnishing conclusive evidence of death are the following:—1. The absence of circulation and respiration for at least an hour, the stethoscope being employed if necessary. 2. The gradual cooling of the body to the temperature of the air, the trunk remaining warm while the members are cold. 3. As the body cools, the gradual supervention of a rigid state of the muscles, successively attacking the limbs and trunk, and ultimately spreading through the whole muscular system. When these conditions are observed, the proofs of death are conclusive, and it is unnecessary to wait for any sign of putrefaction. These changes are as certainly the forerunners of putrefaction as the process of putrefaction is itself the forerunner of the entire destruction of the body. It may be safely said that there has not been a single instance of resuscitation after rigidity had once commenced in a body. During the raging of epidemics, if additional evidence be required for early burial, it might be obtained by exposing a superficial muscle to the galvanic stimulus. If the fibres do not contract, death is certain. If they do, this is no proof that the person can be restored to active life; but further time may be allowed before the body is committed to the grave. For a full discussion of rigor mortis, see a paper by Rossbach. (Vircow's 'Arch.,' Bd. 51, p. 558.)

Putrefaction.—By putrefaction we are to understand those chemical changes which take place in dead animal matter, during which offensive gases are evolved. The ultimate effect of these changes is, after a longer or shorter period, to reduce the organic to the condition of inorganic compounds, consisting chiefly of water, ammonia, and carbonic acid. It is in the stage of transition that noxious effluvia are evolved from which the process derives its name. These consist of compounds of nitrogen, sulphur, carbon, and hydrogen.

This process does not begin to manifest itself in the dead body until after the cessation of rigor mortis, and generally about the third day. It is then observed, if the body has been exposed to the atmosphere in an apartment of mean temperature (60° F.), that the limbs and trunk become supple and pliant, and have a faint odour. The skin covering the abdomen becomes of a pale greenish colour, which gradually deepens. A similar discoloration slowly makes its appearance on the chest, between the ribs, on the face, the neck, the legs, and, lastly, on the arms. The colour appears to depend on the decomposition and infiltration of the animal fluids, especially of the blood, into the skin. In the neck and limbs it is observed to be more marked in the situation of the large venous trunks; and sometimes, indeed, the course of the superficial veins is accurately traced out by greenish-blue or dusky lines, which have been mistaken for marks of violence. Gaseous products are formed, not only in the hollow organs of the abdomen, but beneath the skin generally; so that on making an incision, the edges of the skin are rapidly forced apart or everted. The pressure of the confined gases accounts for the occasional escape of alimentary and fæcal matter from the outlets—also for the escape of blood some days after death from recent wounds involving any of the large veins.

The gases generated in the cavities of the head and face by putrefaction appear to meet with the greatest resistance to their escape. The features become generally swollen or bloated, one or both eyes may be protruded, the eyelids swollen and dark-coloured, the lips swollen and the tongue protruded between them, gaseous matter with fluid escaping in bubbles from the mouth and nostrils. As the skin of the face is generally livid, or even black, it is impossible, under these circumstances, to identify the body. In death from drowning, when the body is afterwards exposed to a warm atmosphere, the gases of putrefaction are so copiously produced that the head appears much larger than natural, and the skin of the trunk and limbs is distended with gas, giving to the whole of the discoloured body a bloated appearance.

Changes in the Viscera.—During putrefaction, various discolorations take place, first in the windpipe, then on the mucous surface of the stomach and bowels, which often closely simulate the effects of disease or poison. The mucous membrane of the stomach may be found of various tints—from a red brown, becoming of a brighter red by exposure to the air, to a deep livid purple or slate colour, and sometimes black from decomposition of the blood. Where the stomach is in contact with the spleen or liver, the lividity is often well marked and clearly defined through all the coats. The peritoneal or outer coat is of a greenish hue, and the course of the superficial vessels is marked by greenish-brown or black lines. These spontaneous changes, which are the result of putrefaction, may be easily mistaken for the effects of irritant poisons. There are no rules that will always enable a medical jurist to distinguish such cases. Much must depend on the progress of putrefaction, and the period after death at which the body is examined: hence each case must be judged by the circumstances which attend it. We may presume that the redness has taken place during life, and is not a result of post-mortem changes:—1. When it is seen soon after death. 2. When it is met with in parts neither dependent nor in contact with other organs gorged with blood. 3. When it is accompanied by a considerable effusion of coagulated blood, mucus, or flakes of membrane, the result of ulceration, corrosion, or destruction of the coats of the viscera. When the body is not inspected until long after death, it is difficult to distinguish these pseudo-morbid appearances from those depending on the action of irritant poison. In a really doubtful case, it is therefore better to withhold an opinion than to express one which must be purely conjectural.

Putrefaction takes place with variable rapidity. It commonly shows itself in this country about the second or third day in warm weather, and about the fifth or sixth day in cold weather. In some instances, however, the body has been found in an advanced state of putrefaction in the short period of sixteen hours after death, and in others the process has been greatly protracted. The time of its appearance is dependent on the duration of rigor mortis, and the condition of the body at the time of death.

The changes caused by putrefaction in the dead body have in some cases been mistaken for those of *gangrene* in the living, and a person has in consequence been wrongly charged with manslaughter. Parts which are the seat of severe injury at the time of death undergo putrefaction more rapidly than those which have not been affected by the accident. When a body has undergone putrefaction generally, the effects of gangrene in a wound may be merged in the changes caused by this process, and great care should be taken in assigning these changes to one or the other condition. Gangrene implies the death of a part in the living body, and putrefactive changes take place in the dead part, as in the entire dead body. If changes resembling those of gangrene are found in a wounded limb while the rest of the body is not in a putrescent state, there may be some reason for the opinion that there was gangrene during life. In this case, however, due allowance should be made for the more rapid decomposition of wounded parts. The best evidence will be that which shows the actual condition of the injured part in the living body. If putrefaction is advanced, the opinion of a person who has not seen the deceased while living can be little more than a conjecture.

POISONING.

CHAPTER 4.

DEFINITION OF THE TERM POISON.—MECHANICAL IRRITANTS.—INFLUENCE OF HABIT AND IDIOSYNCRASY.—CLASSIFICATION.—SPECIAL CHARACTERS OF CORROSIVE, IRRITANT, AND NEUROTIC POISONS.

Definition.—A poison is commonly defined to be a substance which, when administered or taken *in small quantity*, is capable of acting deleteriously on the body: in popular language, this term is applied only to those substances which destroy life in small doses. This popular view of the nature of a poison is too restricted for the purposes of medical jurisprudence. It would obviously exclude numerous compounds, the poisonous properties of which cannot be disputed—as, for example, the salts of copper, tin, zinc, lead, and antimony; these, generally speaking, act as poisons only when administered in *large* doses. Some substances, such as nitre, have not been observed to have a noxious action except when taken in large quantity, while arsenic acts as a poison in a small dose; but in a medico-legal view, whether a man dies from the effects of an ounce of nitre, or two grains of arsenic, the responsibility of the person who criminally administers the substance is the same. Each may be regarded as a poison, differing from the other only in its degree of activity and in its mode of operation. The result is the same; death is caused by the substance taken, and the *quantity* required to destroy life, even if it could be always accurately determined, cannot enable us to distinguish a poisonous from a non-poisonous substance. If, then, a medical witness is asked 'What is a poison?' he must beware of adopting this popular view, or of confining the term "poison" to a substance which is capable of operating as such in one small dose.

In legal medicine, it is difficult to give such a definition of a poison as shall be entirely free from objection. Perhaps the most comprehensive which can be suggested is this: 'A poison is a substance which, when absorbed into the blood, is [by a direct action—Ed.] capable of seriously affecting health or of destroying life.' There are various channels by which poisons may enter the blood. Some poisons are gases or vapours: these operate rapidly through the lungs; others are liquid or solid, and these may reach the blood either through the skin or through a wound; but more commonly through the lining membrane of the stomach or bowels, as when they are taken or administered in the ordinary manner. The latter chiefly give rise to medico-legal investigations. Some substances act as poisons by any one of these channels: thus arsenic is a poison whether it enters the blood through the lungs, the skin, or the stomach and bowels: but such poisons as those of the cobra, the viper, of rabies, and of glanders, appear to greatly affect the body only through a wound. When introduced into the stomach, some of these animal poisons have been found to be almost inert. In adopting the above definition of a poison in a medical sense, it is proper to remark that there are some substances which are regarded as poisons, although absorption into the blood does not appear to be absolutely necessary to their action. The mineral acids and alkalies belong to this class of bodies. They are corrosive poisons: they operate injuriously by causing the destruction of living parts; and whether applied to the skin, the stomach, or (in the form of vapour) to the air-cells of the lungs, they destroy life chiefly by the local changes to which they give rise, and the inflammation which is a consequence of their action.

It is not easy to define the boundary between a medicine and a poison. It is usually considered that a medicine in a large dose is a poison, and that a poison in a small dose is a medicine; but a medicine such as tartarated antimony may be easily converted into a poison by giving it in small doses at short intervals, either under states of the body not adapted to receive it, or in cases in which it exerts an injuriously depressing effect. Some deaths have been occasioned by this wilful misuse of antimony in doses which might be described as *medicinal*, although, in the cases referred to, no other intention could have existed, in the secret administration of this substance, than that of destroying life. A person may die either from a large dose of a substance given at once, or from a number of small doses given at such intervals that the system cannot recover from the effects of one before another is administered. This remark applies to a great number of medicines which are not commonly included in a list of poisons.

In reference to the *medical* definition of a poison, it is necessary to observe that the law does not regard the manner in which the substance administered acts. If it is capable of destroying life or of injuring health, it is of little importance, so far as the responsibility of a prisoner is concerned, whether its action on the body is of a mechanical or chemical nature, and whether it operates fatally by absorption into the blood or not. Thus a substance which simply acts mechanically on the stomach or bowels may, if wilfully administered with intent to injure, involve a person in a criminal charge, as much as if he had administered arsenic or any of the ordinary poisons. It is, then, necessary to consider what the law strictly means by the act of poisoning. If the substance criminally administered destroys life, whatever may be its nature or mode of operation, the accused is tried on a charge of murder or manslaughter, and the duty of a medical witness consists in showing that the substance taken was the certain cause of death. If, however, death is not the consequence, then the accused may be tried for the attempt to murder by poison under the

Criminal Law Consolidation Act, 1861 (24 & 25 Vict. c. 100, s. 11). The words of this statute are general, and embrace all kinds of substances, whether they are popularly or professionally regarded as poisons or not. Thus it is laid down that—

'Whosoever shall administer, or cause to be administered to or taken by any person, any poison, or *other destructive thing*, with intent to commit murder, shall be guilty of felony.'

Whether the administering be followed by any bodily injury or not, the act is still a felony, provided the *intent* has been to commit murder. The attempt to administer or the attempt to cause to be administered to, or to be taken by any person, any poison or *other destructive thing*, with the like intent, although no bodily injury be effected, is also a felony (s. 14). If any doubt formerly existed whether the *external* application of poison, e.g. by wounds or ulcerated surfaces, would be included in the words 'administering or taking,' they are now entirely removed by the above Act. The 22nd section specially applies to such an offence, and the 15th section provides that 'Whosoever shall, by any means other than those specified in any of the preceding sections of this Act, attempt to commit murder, shall be guilty of felony.' Under sect. 22 of this statute, in reference to attempted poisoning, some offences are comprised, which formerly escaped punishment: 'Whosoever shall unlawfully apply or administer to, or cause to be taken by, or attempt to apply or administer to, or attempt to cause to be administered to or taken by any person, any chloroform, laudanum, or other stupefying or overpowering drug, matter, or thing, with intent, in any of such cases, thereby to enable himself or any other person to commit, or with intent, etc., to assist any other person in committing any indictable offence, shall be guilty of felony.'

Poison is not always administered with intent to murder. On many occasions it has been mixed with food, and thus administered with a view to injure or annoy a person. Cantharides have been thus frequently given, and in one instance (Nov. 1859) eight members of a family suffered from severe symptoms of poisoning by reason of the wanton administration of this drug. In April, 1860, several members of a family suffered from severe sickness, as a result of tobacco having been put into water contained in a tea-kettle; and tartar emetic has been in some cases dissolved in beer or other liquids as a mere frolic, without any proved or probable intention on the part of the offender to destroy life. In 1884, a man was tried at the Newington Sessions for poisoning a family by putting corrosive sublimate into a tea-kettle, but was acquitted for want of evidence. In the same year a servant-girl was convicted of poisoning her mistress's beer by means of sulphate of copper (*Reg.* v. *Mary Baker*, C. C. C., Oct. 1884), and was sentenced to fifteen months' hard labour. The case of *M'Mullen* (Liverpool Aut. Ass., 1856) revealed an extensive system of poisoning in the northern counties, in which tartar emetic was the substance employed. This drug, mixed with cream of tartar, was openly sold by druggists under the name of 'quietness powders,' and the evidence established that women gave these powders to their husbands with a view to cure them of habits of drunkenness. Hitherto, when the intent to murder was not proved, the offender has escaped, although great bodily injury may have been done by the wanton or malicious act. Sections 23, 24, and 25 of 24 & 25 Vict. c. 100, provide for this omission:—

'23. Whosoever shall unlawfully and maliciously administer to, or cause to be administered to or taken by any other person, any poison or *other destructive* or *noxious thing*, so as thereby to endanger the life of such person, or so as thereby to inflict upon such person any grievous bodily harm, shall be guilty of felony.'

'24. Whosoever shall unlawfully and maliciously administer to, or cause to be administered to or taken by any other person, any poison or other destructive or noxious thing, with intent to injure, aggrieve, or annoy such person, shall be guilty of a misdemeanour.'

'25. If, upon the trial of any person charged with the felony above mentioned, the jury shall not be satisfied that such person is guilty thereof, but shall be satisfied that he is guilty of the misdemeanour above mentioned, then and in every such case the jury may acquit the accused of such felony, and find him guilty of such misdemeanour.'

It will be perceived that the words of the statute leave the question 'What is a poison?' to depend upon the medical evidence adduced: and in order to include all substances of an injurious nature, although they may not be, strictly speaking, poisons, the words, '*destructive* or *noxious thing*,' are employed. Hence, on these occasions, a medical witness must be prepared to prove that the substance, if not a poison, was a destructive or noxious thing. Judges have taken different views of the meaning of the word *noxious*, and it is well that a witness should be on his guard in dealing with this question, 'What is a noxious substance?' From a case tried in Cornwall, before Cockburn, C.J., it would appear to depend, not on the well-known nature of the substance, but on the *quantity* of it attempted to be administered. In *Reg.* v. *Hennah* (Cornwall Lent Ass., 1877) the prisoner was charged with administering to a woman a poison, cantharides, with intent to injure, aggrieve, and annoy—the real purpose being to excite erotic feelings. The poison was given in two figs, and a glistening appearance which they presented, owing to the shining particles of cantharides, prevented the woman from eating them. One fig was examined by a druggist, and he found it to contain from a grain to a grain and a half of cantharides in powder. This would be equivalent to from two to three grains in the two figs. The druggist, in giving evidence, said that this quantity of cantharides would be insufficient to produce any effect upon the human system, and further stated, by misquotation of this manual, that a fatal dose would amount to twenty-four grains. It was ingeniously contended in defence that if what was administered could produce no effect, it would not in law amount to administering a 'noxious' thing as required by the statute. This view was accepted by the Lord Chief Justice, and he directed an acquittal. He ruled that, unless the thing is noxious in the *quantity* administered, it cannot be said that there has been a noxious thing administered. He said, further, that there must be a distinction between a thing only noxious when given in excess, and a thing which is a recognized poison and is known to be a thing noxious and pernicious in its effect. The fallacy of this reasoning will be apparent when it is stated that cantharides is a poison recognized by law as well as in medicine; that it finds a place in the schedule of the Act for regulating the sale of poisons, by the side of strychnine, prussic acid, and arsenic; and further, that these substances operate as poisons or are noxious only when given in excess, *i.e.* beyond a medicinal dose. The court was no doubt misled on this occasion by relying upon the opinion of a druggist. The quantity of cantharides attempted to be administered was quite sufficient to cause irritation of the bladder, strangury, and other unpleasant symptoms, and this would surely come under the head of annoyance or injury to health. Maclagan reports an instance in which one grain and a half of cantharides, in three pills, caused strangury, and the substance was necessarily withdrawn. ('Brit. Med. Jour.,' 1877, i. p. 466.) Until the above judgment has been overruled, medical witnesses must look closely to the quantity of the substance administered, and duly consider whether this was such as to be likely to injure, aggrieve, or annoy a person. The quantity of a poison wilfully administered does not affect the culpability of the person administering it.

Mechanical Irritants.—The substance administered may not be a poison in the medical signification of the term, and it may not be popularly considered such; yet, when taken, it may be noxious to health or destructive to life. We have examples of substances of this description in iron filings, powdered glass, sponge, pins, needles, and such-like bodies, which have been administered with the wilful design of injuring, and have on various occasions given rise to criminal charges. In cases of this kind, the legal guilt of a prisoner may often depend on the meaning assigned by a medical witness to the words *destructive thing.* Thus, mercury might be poured down the throat of an infant, with the deliberate intention to destroy it. A question of a purely medical nature will then arise whether mercury is a 'destructive thing' or not; and the conviction of a prisoner will probably depend on the answer. Should a difference of opinion exist —an occurrence by no means unusual in medical evidence—the prisoner will receive the benefit of the doubt. The injuries produced on cattle by mechanical irritants have occasionally given rise to civil actions for damages.

Influence of Habit on Poisons.—Habit, it is well known, diminishes the effects of certain poisons: thus it is that opium, when frequently taken, loses its effect for a time, and requires to be administered in much larger doses. Indeed, confirmed opium-eaters have been enabled to take at once a quantity of the drug which would have killed them had they commenced with it in the first instance. Even infants and children, who are well known to be especially susceptible of the effects of opium, and are liable to be poisoned by small doses, may, by the influence of habit, be brought to take the drug in very large quantities. It appears that the system of drugging children with opium in the factory districts and in the fens commences as soon after birth as possible; and the dose is gradually increased until it reaches fifteen to twenty drops of laudanum at once. This has the effect of throwing the child into a lethargic stupor. Healthy children of the same age would be killed by a dose of five drops. The same influence of habit is manifested more or less in the use of tobacco, alcohol, ether, chloroform, morphine, strychnine, and other alkaloids. Christison has remarked that this influence is chiefly confined to poisons derived from the organic kingdom; it is so limited with regard to mineral substances that it can scarcely be said to exist, except in the case of arsenic and corrosive sublimate.

As to the practice of arsenic-eating, Roscoe has published a case in which, according to information supplied to him, a Styrian peasant took in one day four grains and a half, and on the day following five grains and a half of white arsenic, crushing the mineral between his teeth and swallowing it. The day after he had swallowed the second dose, the man left the place in his usual health, and there is no further record of him. R. C. Maclagan states that he saw a Styrian peasant, æt. 26, swallow between four and five grains of white arsenic in powder. In two hours some urine which he passed contained arsenic. This man suffered no ill effects; he stated that he had taken arsenic for a year and a half without any injury to his health. He took at first rather less than a grain every fortnight. In another case a man, æt. 46, swallowed six grains. In three quarters of an hour it was found that arsenic was eliminated with the urine. ('Ed. Med. Jour., 1864, x. p. 200.) Knapp informed Maclagan that a man once took in his presence seven and a half grains of arsenic, and no injurious effects were produced. (Ibid., 1865, x. p. 669.) *Habit* appears to have so little influence on arsenic, under the most careful medicinal use of it in this country, that no medical practitioner has ever succeeded in causing a patient to take *two grains* at a dose, the smallest quantity yet known to have destroyed life. Hunt, who had had a large experience in the use of this mineral, fixed the maximum dose to be given with safety at one grain.

A case reported in the above journal (1864, x. p. 116) shows the danger incurred by this practice. A man who had taken arsenic for a period of three or four years died under the usual symptoms of chronic poisoning. As far as it could be ascertained, the daily dose taken by deceased for the last five months of his life was from two to three grains. From the beginning of the practice he had suffered from symptoms of poisoning with arsenic, gradually assuming the form of arsenical cachexia; but he referred the symptoms to other causes, and concealed the practice from his friends. He never became habituated to the poison. This is a result which may be generally expected. If the exceptional cases observed in Styria are supposed to prove that arsenic may be taken in large does with impunity, they would lead to error. Such cases have no practical bearing in legal medicine. If the practice of arsenic-eating produces no symptoms, then no question of poisoning can arise. If, as in the above case, it does produce symptoms, then the case would fall within the range of ordinary experience. The impunity of the Styrians, in the habitual use of arsenic, may be occasionally quoted to explain the detection of the poison in a dead body or a motive for its purchase; but no scientific witness who has seen anything of the operation of arsenic can allow these statements to influence his opinion of its ordinary effects on human beings.

The only form in which the question of habit can be seriously raised in medical jurisprudence is this: whether, while the more prominent effects of a poison are thereby diminished, the insidious effects on the constitution are at the same time counteracted. The answer is of some importance in relation to the subject of life-insurance; for the concealment of the practice of opium-eating by persons whose lives were insured, has given rise to actions, in which medical evidence on this subject was rendered necessary. As a general principle, we must admit that habit cannot altogether counteract the insidious effects of poisons; and that the practice of taking them is liable to give rise to disease or to impair the constitution.

Influence of Idiosyncrasy.—Idiosyncrasy differs from habit: it does not, like habit, diminish the effect of a poison; for it is not commonly found that any particular state of body is a safeguard against the effects of these powerful agents. Some persons are observed to be much more affected than others by certain poisons; thus, opium, arsenic, mercury, lead, iodide of potassium, and antimony are substances of this description, and this difference in their effects is ascribed to idiosyncrasy. Christison mentions a remarkable instance, in which a gentleman, unaccustomed to the use of opium, took nearly an ounce of laudanum without any effect. This form of idiosyncrasy is very rare. Certain substances generally reputed harmless, and, indeed, used as articles of food, are observed to affect some persons like poisons. This is the case with pork, certain kinds of shell-fish, and mushrooms. There may be nothing poisonous in the food itself; but it acts as a poison to particular persons—whether from its being in these cases a poison *per se*, or rendered so by changes during the process of digestion, it is difficult to say. The subject of idiosyncrasy is of importance in a medico-legal view when symptoms resembling those of poisoning follow a meal consisting of a particular kind of food. In such a case, without a knowledge of this peculiar condition, we might hastily attribute to poison effects which were really due to another cause. It would appear that in some instances idiosyncrasy may be acquired—*i.e.* a person who, at one period of his life, had been in the habit of partaking of a particular kind of food without injury, may find at another period that it will disagree with him. When pork has been disused as an article of dietary for many years, it cannot always be resumed with impunity. In cases in which the powers of life have become enfeebled by age, the susceptibility of the system to poisons is increased; thus aged persons may be killed by comparatively small doses of arsenic and opium. In 1883, the editor found that an aged woman died narcotised after taking an opiate containing less than one grain of opium—a dose which on previous occasions she had occasionally taken with impunity. Cases of acquired idiosyncrasy are very rare: it appears to be, if we may so apply the term, a congenital condition. There are, however, certain diseases which seem to confer a power of supporting large and even poisonous doses of some substances. Very large doses of opium have been taken without producing dangerous symptoms by persons labouring under tetanus and hydrophobia. This condition is called *tolerance.* It has been witnessed in diseases of the lungs in reference to the use of antimonial medicines.

CLASSIFICATION OF POISONS.—Poisons may be divided into two classes, according to their mode of action on the system; namely, IRRITANTS and NEUROTICS, as the special action of the latter is to affect directly one or more parts of the nervous system. No satisfactory classification has, however, been hitherto proposed.

IRRITANTS.—The irritants are possessed of these common characters. When taken in ordinary doses, they occasion speedily violent vomiting and purging. The symptoms are either accompanied or followed by pain in the stomach and bowels. The peculiar effects of the poison are manifested chiefly on these organs, which, as their name implies, they irritate and inflame. Many substances belonging to this class of poisons possess corrosive properties; such as the strong mineral acids, caustic alkalies, bromine, corrosive sublimate, and others. These, in the act of swallowing, are commonly accompanied with an acrid or burning taste, extending from the mouth down the gullet to the stomach. Some irritants do not possess any corrosive action—of which we have examples in white arsenic, the poisonous salts of barium, carbonate of lead, and cantharides: these are often called pure irritants. They exert no destructive chemical action on the tissues with which they come in contact; they simply irritate and inflame them.

Difference between Corrosive and Irritant Poisons.—As a result of the action of *corrosive* poisons, symptoms are commonly manifested immediately, because mere contact produces the destruction of a part. In the action of the purely *irritant* poisons, the symptoms are generally more slowly manifested, rarely showing themselves until at least half an hour has elapsed from the time of swallowing the substance. Of course, there are exceptions to this remark; for sometimes irritants act speedily, though rarely with the rapidity of corrosive poisons. It is important in a practical view to ascertain whether, in an unknown case, the poison which a person requiring immediate treatment may have swallowed, is irritant or corrosive. This may be commonly determined by a knowledge of the time at which the symptoms appeared after the suspected substance was taken. We may thus often easily distinguish between a case of poisoning from arsenic and one from corrosive sublimate. There is also another point which may be noticed. As the corrosive substance exerts a local chemical action, an examination of the mouth and throat may enable us in some cases to solve the question.

It has already been stated that there are many irritant poisons which have no corrosive properties, but every corrosive may act as an irritant. Thus the action of corrosive sublimate is that of an irritant poison, as, while it destroys some parts of the coats of the stomach and intestines, it irritates and inflames others. So again most corrosive poisons may lose their corrosive properties by dilution with water, and they then act simply as irritants. This is the case with the mineral acids and bromine. In some instances it is not easy to say whether an irritant poison possesses corrosive properties or not. Thus oxalic acid acts immediately, and blanches and softens the mucous membrane of the mouth and throat, but it is rare to meet with any decided marks of chemical corrosion produced by it in the stomach or viscera. Irritant poisons, for the most part, belong to the mineral kingdom; and they may be divided into the *Non-Metallic* and *Metallic Irritants.* There are a few derived from the animal and vegetable kingdoms; but these, if we except cantharides, are not often employed criminally. Some of the gases likewise belong to the class of irritant poisons.

NEUROTICS.—Neurotic poisons act upon the nervous system. Either immediately or some time after the poison has been swallowed, the patient suffers from headache, giddiness, numbness, paralysis, stupor, or convulsions. They have not an acrid burning taste like the corrosive irritants; and they rarely give rise to purging. When vomiting or purging follow the ingestion of the poison into the stomach, the effects may be generally ascribed either to the form or quantity in which it has been taken, and the mechanical effect on the stomach thereby produced, or to the poison being combined with some irritating substance, such as alcohol. The pure *narcotics*, or *cerebral poisons*, are not found to irritate or inflame the stomach and bowels.

Notwithstanding the well-defined boundary thus apparently existing between these classes of poisons, it must not be supposed that the substances arranged in each class always act in the manner indicated. Some irritants have been observed to affect the brain or the spinal marrow, and this may be either a primary or a secondary consequence of their action. Arsenic and oxalic acid, although classed as irritants, have in some instances given rise to symptoms closely resembling those of narcotic poisoning; namely, coma, paralysis, and tetanic convulsions. In a case of poisoning by arsenic, which occurred to Morehead, the symptoms of narcotism were so strongly marked that it was believed at first the man had taken a narcotic. ('Med. Gaz.,' vol. 43, p. 1055.) A case has been met with of poisoning by arsenic in which there was paralysis of the limbs, with an entire absence of purging during the eight days that the deceased survived. On the other hand, in a case of poisoning by a large dose of opium, there was an absence of the usual symptoms of cerebral disturbance, and the presence of others resembling those of irritant poisoning—namely, pain and vomiting. Thus, then, we must not allow ourselves to be misled by the idea that the symptoms are always clearly indicative of the kind of poison taken. The narcotic or cerebral poisons belong mostly to the vegetable kingdom. Some of the poisonous gases possess a narcotic action.

Some poisons have a complex action. They are chiefly derived from the vegetable kingdom. At variable periods after they have been swallowed, they give rise to vomiting and purging, like irritants; and sooner or later produce stupor, coma, paralysis, and convulsions, owing to their effects on the brain and spinal marrow. In the state of vegetables, as leaves, seeds, or roots, they possess the property, like irritants, of irritating and inflaming the stomach and bowels. As familiar examples we may point to nux vomica, monkshood, hemlock, and poisonous mushrooms. These poisons are very numerous, embracing a large variety of well-known vegetable substances; but they rarely form a subject of difficulty to a medical practitioner. The fact of the symptoms occurring after a meal at which some suspicious vegetables may have been eaten, coupled with the nature of the symptoms themselves, will commonly indicate the class to which the poison belongs. Some of these poisons have a hot acrid taste; others, like aconite or monkshood, produce a sense of numbness or tingling; while others again have an intensely bitter taste, as nux vomica, strychnine, veratrine, and picrotoxin. Strychnine may be regarded as a pure spinal poison.

In the description of poisons no systematic classification can be consistently followed.

CHAPTER 5.

EVIDENCE OF POISONING IN THE LIVING BODY.—ACTION OF POISONS INCREASED OR DIMINISHED BY DISEASE.—SYMPTOMS CONNECTED WITH FOOD OR MEDICINE.—SEVERAL PERSONS ATTACKED SIMULTANEOUSLY.—EVIDENCE FROM THE DETECTION OF POISON IN THE FOOD.

We now proceed to consider the evidence of poisoning in the *living* body. To the practitioner the diagnosis of a case of poisoning is of great importance, as, by mistaking the symptoms produced by a poison for those arising from natural disease, he may omit to employ the proper remedial measures, and thus assuredly lead to the death of the patient. To a medical jurist a correct knowledge of the symptoms furnishes the chief evidence of poisoning, in those cases in which persons are charged with the malicious and unlawful administration of poison. The symptoms produced during life constitute also an important part of the evidence in those instances in which a poison proves fatal. At present, however, we will suppose the case to be that poison has been taken and the patient survives. Most toxicological writers have laid down certain characters whereby it is said symptoms of poisoning may be distinguished from those of disease.

1. *In poisoning, the symptoms appear suddenly, while the individual is in health.*—It is the common character of most poisons, when taken in the large doses in which they are usually administered with criminal intent, to produce serious symptoms, either immediately or within a very short period after they have been swallowed. Their operation, under such circumstances, cannot be suspended, and then manifests itself after an indefinite interval; although this was formerly a matter of universal belief, and gave rise to many absurd accounts of what was termed *slow* poisoning.

The symptoms of poisoning by nicotine, prussic acid, oxalic acid, or the salts of strychnine, appear immediately, or generally within a very few minutes after the poison has been swallowed. In an exceptional case, in which the dose of prussic acid was small, and insufficient to produce death, the poison was supposed by the patient not to have begun to act until after the lapse of fifteen minutes. ('Ed. Med. and Surg. Journ.,' vol. 59, p. 72.) The symptoms caused by arsenic and other irritants, and, indeed, by poisons generally, are commonly manifested in from half an hour to an hour. It is rare that the appearance of symptoms is protracted for two hours, except under certain peculiar states of the system. It is said that some neurotic poisons, such as the poisonous mushrooms, may remain in the stomach twelve or twenty-four hours without giving rise to symptoms; and this is also affirmed to be the case with some animal irritants, such as decayed meat; but with regard to mushrooms, it has been shown by Peddie that they have produced symptoms in half an hour; and a case fell under the author's own observation in which the symptoms from noxious animal food came on within as short a time after the meal as is commonly observed in irritant poisoning by mineral substances. In some cases of poisoning by phosphorus, no obvious symptoms have occurred until after the lapse of some days.

Influence of Disease.—A *diseased* state of the body may render a person comparatively insusceptible of the action of certain poisons, while in other instances it may increase their action and render them fatal in small doses. In dysentery and in tetanus a person may take, without being materially affected, a quantity of opium sufficient to kill an adult in average health. In mania, cholera, hysteria, and delirium tremens, large doses of opium may be borne with comparative impunity. In a case of hemiplegia, a woman, æt. 29, took for six days three grains of strychnine daily without injurious consequences—the dose having been gradually raised ('Gaz. Méd.,' Mai, 1845); while one grain of strychnine is commonly regarded as a fatal dose to a healthy adult. In a case of tetanus, Dupuytren gave more than two ounces of opium at a dose (60 grammes) without serious consequences. (Flandin, 'Traité des Poisons,' vol. 1, p. 231.) It has also been remarked that persons affected with tetanus are not easily salivated by mercury. The morbid state appears to create the power of resisting the ordinary effects of poisons. The effect of certain diseases of the nervous system, as well as of habit, either in retarding the appearance of symptoms, or in blunting the operation of a poison, it is not difficult to appreciate; they are cases which can present no practical difficulty to a medical jurist. On the other hand, in certain diseased states, there may be an increased susceptibility of the action of poison. Thus, in those persons who have a predisposition to apoplexy, a small dose of opium may act more quickly and prove fatal. In a person labouring under inflammation of the stomach or bowels, there would be an increased susceptibility of the effects of arsenic, antimony, or other irritants. In debility from any cause these mineral substances would also act injuriously even in ordinary doses. Antimony is a most powerful depressant, and might, by its effect on the heart, cause sudden death by syncope. The influence of disease in increasing the operation of poison has been noticed in cases of diseased kidney (granular degeneration), in which small doses of mercury have produced severe salivation, leading to exhaustion and death. In diseases of the lungs affecting aged persons, opium in medicinal doses has been observed to exert a poisonous action. The effect of the drug appears to be intensified by the disease. This observation applies equally to morphine. A fatty condition of the muscular tissue, leading to great feebleness of the heart's action, appears to be highly favourable to death by syncope under the use of chloroform. A knowledge of these facts is of importance in reference to charges of malapraxis when death has arisen from ordinary or extraordinary doses of medicines administered to persons labouring under disease. In such cases, another mode of treatment should be substituted, or a smaller dose than usual given, and its effects carefully watched. In some instances, however, full and large doses of powerful drugs have been recklessly given, and when a fatal result has followed, there has been a strong disposition to refer death to the supposed disease, of which, however, sometimes no trace could be found in the body.

Symptoms appear during a state of health.—Symptoms of poisoning may manifest themselves in a person while in a state of *perfect health*, without any apparent cause. This rule is, of course, open to numerous exceptions, because the person on whose life an attempt has been made may be actually labouring under disease; and under these circumstances, the symptoms may be so obscure as often to disarm all suspicion. When poison is secretly given in medicine, a practitioner is very liable to be deceived, especially if the disease under which the person is labouring is of an acute nature, and is attended with symptoms of disorder in the alimentary canal. Several cases of poisoning have occurred in which arsenic was criminally substituted for medicine, and given to the persons while labouring under a disorder of the bowels. We are, however, justified in saying, with respect to this character of poisoning, that when, in a previously healthy person, violent vomiting and purging occur suddenly and without any assignable cause, such as disease, indiscretion in diet, or pregnancy, to account for them, there is reason to suspect that irritant poison has been taken. When the patient is already labouring under disease, we must be especially watchful of the occurrence of any sudden change in the character or violence of the symptoms, unless such change can be easily accounted for on well-known medical principles. In most cases of criminal poisoning we meet with alarming symptoms without any obvious or sufficient natural causes to explain them. The practitioner will, of course, be aware that there are certain diseases which are liable to occur suddenly in healthy people, the exact cause of which may not at first sight be apparent; therefore this criterion is only one out of many on which a medical opinion should be founded.

2. *In poisoning the symptoms appear soon after a meal, or soon after some kind of food or medicine has been taken.*—This is by far the most important character of poisoning in the living body. It has been already stated that most poisons begin to operate within about an hour after they have been swallowed; and although there are a few exceptions to this remark, yet they occur under circumstances easily to be appreciated by a practitioner. Thus, then, it follows that, supposing the symptoms under which a person is labouring to depend on poison, the substance has most probably been swallowed, either in food or medicine, from half an hour to an hour previously. It must be observed, however, that cases may occur in which the poison has not been introduced by the mouth. Oil of vitriol and other corrosive liquids have been thrown up the rectum in enemata, and have thus caused death; the external application of arsenic, corrosive sublimate, and cantharides to ulcerated surfaces has destroyed life. In one case arsenic was introduced into the vagina of a female, and she died in five days under all the symptoms of arsenical poisoning. (Schneider, 'Ann. der Ges. Staatsarzneikunde,' i. 229.) Such cases are rare, but, nevertheless, the certainty that they have occurred, where their occurrence could hardly have been anticipated, shows that in a suspicious case a medical man must not deny the fact of poisoning merely because it may be proved that the person could not have taken the poison in the usual way, by the mouth. Again, persons may be destroyed by the vapours of ether, chloroform, prussic acid, or other powerful volatile poisons, introduced into the body through the lungs. Such a mode of suicide, or murder, might disarm suspicion, from the fact of no noxious material being found in the stomach.

Let us suppose, however, the circumstances to have been such that these secret means of destruction could not have been resorted to, and that the poison is one of those most commonly selected by a murderer, such as white arsenic, tartar emetic, oxalic acid, strychnine, or corrosive sublimate; then we may expect that this character of poisoning will be made evident to us, and that something must have been *swallowed* by the patient shortly before the alarming symptoms appeared. By observations attentively made, it may be in our power to connect the appearance of the symptoms with the use of a particular article of food, and thus indirectly lead to the detection of a criminal. Supposing that many hours have passed since food or medicine was taken by the patient, without any effect ensuing—it is probable that the symptoms may be due to natural causes and not to poison. When symptoms resembling those of poisoning speedily follow the ingestion of food or medicine, there is, however, reasonable ground for suspicion; but caution should be observed in drawing inferences, since the most extraordinary coincidences sometimes present themselves. In the case of *Sir Theodosius Boughton*, who was poisoned by his brother-in-law, Donellan, in 1781, the fact of alarming symptoms coming on in *two minutes* after the deceased had swallowed what was supposed to be a simple medicinal draught, was a most important part of the evidence against the prisoner. There is no doubt that laurel-water had been substituted for the medicine by the prisoner, and that this had caused the symptoms which preceded death. The practice of substituting poisonous mixtures for medicinal draughts or powders is by no means unusual, although it might be supposed to indicate a degree of refinement and knowledge not commonly to be found among criminals. Medical practitioners are thus apt to be imposed upon, and the following case will serve as a caution. An apothecary prepared a draught, into which another person put poison, intending thereby to destroy the life of a patient for whom the medicine was prescribed. The patient, not liking the taste of the draught, and thinking there was something suspicious about it, sent it back to the apothecary, who, knowing the ingredients of which he had composed it, and wishing to prove to his patient that he had done nothing wrong, drank it himself, and died from the effects. He was thus the unconscious agent of his own death; and although the draught was intended for another, the party who poisoned it was held guilty of murder. This case contains a warning to medical witnesses. On trials for poisoning, when the poison is conveyed though medicine, a medical witness has offered to swallow his own draught in a court of law, in order to furnish a convincing practical illustration of the innocence of the medicine. It need hardly be observed that an exhibition of this kind is never required of a witness. If any doubt be raised of the innocent properties of a draught or powder, an analysis of its contents will be far more satisfactory as evidence, and be attended with no risk to the practitioner.

On the other hand, the occurrence of symptoms resembling those produced by poisoning, soon after food or medicine has been taken, may be a pure coincidence. In such a case, poison is always suspected by the vulgar; and it will be the duty of a medical jurist to guard against the encouragement of such a suspicion, until he has strong grounds to believe it to be well founded. No public retractation or apology can ever make amends for the injury which may in this way be inflicted on the character of another; for those who hear the accusation may never hear the defence. In all such cases, a practitioner may entertain a suspicion; but, until confirmed by facts, he should avoid *expressing* it or giving it publicity. When death is not a consequence, it is difficult to clear up such cases except by the aid of a chemical analysis; but this, as we know, is not always applicable. If death ensue, the real cause is usually apparent, and a suspicion of poisoning is thus often removed by an examination of the body. Cases are reported in which persons have died suddenly after a meal, and the cause of death has been traced to obstruction of the air-passages by food.

3. *In poisoning, when several partake at the same time of the same food or medicine (mixed with poison) all suffer from similar symptoms.*—This character of poisoning, when it exists, furnishes good evidence of the fact. Thus, supposing that after a meal made by several persons from the same dish, only one suffers, the suspicion of poisoning is considerably weakened. The poisoned article of food may be detected by observing whether they who suffer under any symptoms of poisoning have partaken of one particular solid or liquid in common. In a case of accidental poisoning at a dinner-party, a medical man who was present observed that those who suffered had taken port wine only : the contents of the bottle were examined, and found to be a saturated solution of arsenic in wine. In general, considerable reliance may be placed upon this character, because it is improbable that any common cause of disease should suddenly attack with violent symptoms of a similar character many healthy persons at the same time, and within a short period after having partaken of food together. We must beware of supposing that, when poison is really present, all will be attacked with precisely similar symptoms ; because there are many circumstances which may modify their nature and progress. In general that person who has partaken most freely of the poisoned dish will suffer most severely; but even this does not always follow. There is a well-known case, recorded by Bonnet, where, among several persons who partook of a dish poisoned with arsenic, they who had eaten little and *did not vomit,* speedily died; while others who had partaken largely of the dish, and had in consequence vomited freely, recovered.

It was just now remarked that there is no disease resembling poisoning which is likely to attack several healthy persons at the same time and in the same manner. This is undoubtedly true as a general rule, but the following case will show that mistakes may occasionally arise even under these circumstances. It occurred in London, during the prevalence of cholera in the year 1832. Four of the members of a family, living in a state of great domestic unhappiness, sat down to dinner in apparently good health; some time after the meal, the father, mother, and daughter were suddenly seized with violent vomiting and purging. The evacuations were tinged with blood, while the blueness of the skin, observed in cases of cholera, was absent. Two of these persons died. The son, who was known to have borne ill will against his father and mother, and who suffered no symptoms on this occasion, was accused of having poisoned them. At the inquest, however, it was clearly shown by the medical attendant that the deceased persons had really died of cholera, and there was no reason to suspect that any poison had been administered to them. In this instance it will be perceived that symptoms resembling those of irritant poison appeared suddenly in several individuals in perfect health, and shortly after a meal. We hereby learn that the utility of any rules for investigating cases of poisoning depends entirely on the judgment and discretion with which they are applied to particular cases.

It is well to bear in mind, in conducting these inquiries, that symptoms resembling those produced by irritant poison may be sometimes traced to *food.* Meat, rendered unwholesome by disease or decay, pork, bacon, sausages, cheese and bread, as well as mussels and other kinds of shell-fish, may give rise to symptoms of poisoning, and even cause death. Such cases may be regarded as poisoning by animal or vegetable irritants. All the characters above described, as indicative of poisoning, may be observed, and the difficulty of forming an opinion is often increased by the fact that some of the persons attacked may have previously partaken of the same kind of food without inconvenience.

4. *The discovery of poison in the food taken or in the matters vomited.*—One of the strongest proofs of poisoning in the living subject is the detection of poison by chemical analysis; or, if of a vegetable nature, by a microscopical examination, either in the food taken by the person labouring under its effects, in the matters vomited, or in the urine. The evidence is, of course, more satisfactory when the poison is detected in the matters vomited or in the urine, than in the food, because this will show that it has really been taken, and it will readily account for the symptoms. If the vomited matters have been thrown away, we must examine the food of which the patient may have partaken. Should the results in both cases be negative, and no trace of poison be found in the urine, it is probable that the symptoms were due to disease.

In investigating a case of poisoning in a living subject, a medical jurist must remember that poisoning is sometimes *feigned*, and at others *imputed.* It is easy for an artful person to put poison into food, as well as to introduce it into the matters vomited or discharged from the bowels, and to accuse another of having administered it. There are few of these accusers who go so far as to swallow poison under such circumstances, as there is a great dread of poisonous substances among this class of criminals; and it will be at once apparent that it would require a person well versed in toxicology to feign such a series of symptoms as would impose upon a practitioner at all acquainted with the subject. In short, the difficulty reduces itself to this: What inference can be drawn from the detection of poison in food? All that a medical man can say is, whether poison is or is not present in a particular article of food: he must leave it to the authorities of the law to develope the alleged attempt at administration. If the poison has been actually administered or taken, then we should expect to find that the person had suffered from the usual symptoms. The absence of these symptoms would be a strong fact against the alleged administration. The detection of poison in the matters vomited affords no decisive proof that it has been swallowed, except under two circumstances: 1. When the accuser has previously laboured under the usual symptoms of poisoning, in which case there will be no feigning, and the question of imputation is a matter to be established by general evidence. 2. When the matters are actually vomited into a *clean vessel* in the presence of the medical attendant himself, or of some person on whose testimony perfect reliance can be placed. The detection of absorbed poison in the *urine*, passed in the presence of the medical attendant, furnishes a clear proof that poison has been taken, that it has passed into the blood, and has been subsequently eliminated.

When a medical man is called to a case of suspected poisoning, it is necessary that he should know to what points he ought to give his attention. Every effort should be made by him to save life when the individual is living; but, while engaged in one duty, it is also in his power to perform another, supposing the case to be one of suspected criminal poisoning, namely, to note down any circumstances which may tend to detect the perpetrator of a crime. There is no person so well fitted to observe these points as a medical man; but it unfortunately happens that many facts important as evidence are often overlooked. The necessity for observing and recording them is not, perhaps, generally known. A medical man should not make himself officious on such occasions, but he would be unmindful of his duty as a member of society if he did not aid the cause of justice by extending his scientific knowledge to the detection of crime. It is much to the credit of the medical profession that the crime of murder by poisoning—a form of death from which no caution or foresight can protect a person—is so frequently brought to light by the announcement of suspicious facts of a medical nature to magistrates and coroners.

The following are the principal points which demand the attention of a medical jurist in all cases of suspected poisoning:—1. The time of the occurrence of symptoms, and their nature. 2. The exact period at which they were observed to take place after a meal, or after food or medicine had been taken. 3. The order of their occurrence. 4. Whether there was any remission or intermission in their progress; or, whether they continued to become more and more aggravated until death. 5. Whether the patient had laboured under any previous illness. 6. Whether the symptoms were observed to recur more violently after a particular meal, or after any particular kind of food or medicine. 7. Whether the patient has vomited. The vomited matters, if any (especially those *first* ejected), should be procured; their odour, colour, and acid or alkaline reaction noted, as well as their quantity. 8. If none be procurable, and the vomiting has taken place on the dress, furniture, or floor of a room, then a portion of the clothing, sheet, or carpet may be cut out and reserved for analysis; if the vomiting has occurred on a deal floor, a portion of the wood may be scraped or cut out; or if on a stone pavement, then a clean sponge soaked in water may be used to remove any traces of the substance. The vessel in which vomited matters have been contained will often furnish valuable evidence, since heavy mineral poisons fall to the bottom, or adhere to the sides. 9. Endeavour to ascertain the probable nature of the food or medicine last taken, and the exact *time* at which it was taken. 10. Ascertain the nature of *all* the different articles of food used at a meal. 11. Any suspected articles of food, as well as the vomited matters, should be sealed up as soon as possible in clean glass vessels, labelled (the labels being attached by seals), and reserved for analysis. 12. Note down, in their own words, all explanations voluntarily made by persons present, or who are supposed to be concerned in the suspected poisoning. 13. Note whether more than one person partook of the food or medicine; and if so, whether all these persons were affected, and how? 14. Note whether the same kind of food or medicine had been taken before or since by the patient or other persons without ill effects following.

CHAPTER 6.

EVIDENCE OF POISONING IN THE DEAD BODY.—PERIOD AT WHICH POISONS PROVE FATAL.—CHRONIC POISONING.—APPEARANCES PRODUCED BY THE DIFFERENT CLASSES OF POISONS.—REDNESS OF THE MUCOUS MEMBRANE MISTAKEN FOR INFLAMMATION.—ULCERATION AND CORROSION.—SOFTENING. —PERFORATION OF THE STOMACH FROM POISON AND DISEASE.

Supposing that the person is dead, and we are required to determine whether the case is one of poisoning or not, we must, in the first instance, endeavour to ascertain all the particulars which have been considered in the last chapter as indicative of poisoning in the living body. Should the deceased have died from poison, the circumstances of the attack, and the symptoms preceding death, ought to correspond with the characters already described; and in these investigations it is well to bear in mind the following rule: there is no one symptom or pathological condition which is peculiar to poisoning; but at the same time there is probably no disease which presents *all* those characters which are met with in an actual case of poisoning. The points which require to be specially noticed under these circumstances in the living, are described at pp. 6 to 8, *ante.* The additional evidence to be derived from the *death* of a person may be considered under the following heads:—

1. *The time at which death takes place after the first occurrence of symptoms.*—This question requires examination, because the more common poisons, when taken in fatal doses, generally cause death within definite periods of time. By an attention to this point we may, in some instances, be enabled to negative a charge of poisoning, and in others to form an opinion of the kind of poison which has been taken. In a court of law, a medical practitioner is often required to state the usual *period of time* within which poisons prove fatal. It is to be observed that not only do poisons differ from each other in this respect, but the same substance, according to the form or quantity in which it has been taken, may differ in the rapidity of its action. A large dose of the ordinary solution of prussic acid, *i.e.* from half an ounce to an ounce, may destroy life in less than two minutes. In

ordinary cases of poisoning by this substance a person dies, *i.e.* all signs of life have commonly ceased, in from ten to twenty minutes; and it he survives half an hour, there is some hope of recovery. In the cases of seven epileptics, accidentally poisoned by a similar dose of this acid in one of the Parisian hospitals, the first died in about twenty minutes; the seventh survived three quarters of an hour. Oxalic acid, one of the most energetic of the common poisons, when taken in a dose of from half an ounce to an ounce, may destroy life in from ten minutes to an hour; but if the poison is not completely dissolved when swallowed, it is a longer time in proving fatal. The strong mineral acids, in poisonous doses, destroy life in about eighteen or twenty-four hours. White arsenic operates fatally in from eight hours to three or four days. It has, however, in more than one instance, killed a person in two hours. Opium, either as a solid or in the form of laudanum, commonly proves fatal in from six to twelve hours; but it has been known, in several instances, to destroy life in less than three hours: they who survive the effects of this poison for twelve hours are considered to have a fair chance of recovery. This must be understood to be merely a statement of the average results, as nearly as we are warranted in giving an opinion; but the medical jurist will, of course, be aware that the fatal period may be protracted or shortened, according to all those circumstances which have been elsewhere stated to affect the action of poisons.

There are various forms which this question may assume. It may be said that the death of a person, alleged to have taken poison, has occurred either too rapidly or too slowly to justify a suspicion of poisoning. The following case will serve as an illustration: A woman was tried and convicted (*Reg.* v. *Russell*, Lewes Sum. Ass., 1826) of the murder of her husband by arsenic. The poison was detected in the stomach; but the fact of poisoning was disputed by some medical witnesses, for this, among other reasons, that the deceased had died *three* hours after the only meal at which the poison could have been administered to him. Authorities were cited to show that, according to their experience, they had never known a case of poisoning by arsenic to have proved fatal in less than seven hours. This may be admitted; but, at the same time, there was sufficient authority on the other side to establish that some cases had actually proved fatal in three or four hours. So far as this objection was concerned, the prisoner was properly convicted. In reference to the medical question raised at this trial, it may be observed that two distinct cases have since occurred in which the persons died certainly within *two hours* after taking arsenic; and several instances have been reported in which death has taken place in from three to four hours after the administration of this poison. It seems extraordinary that any attempt should have been made by a professional man to negative a charge of criminal poisoning upon so weak a ground as this; but this opinion was expressed many years ago, when the facts connected with poisoning were but little known. It is obvious that there is nothing, so far as we know, to prevent arsenic from destroying life in an hour, or even within a shorter period. A case will be hereafter related in which death took place from arsenic probably within twenty minutes. These matters can be settled only by a careful observation of numerous cases, and not by any *à priori* reasoning, or by a limited individual experience.

In all instances of sudden death there is generally a strong tendency on the part of the public to suspect poisoning. They never can be brought to consider that persons may die a natural death *suddenly*, as well as slowly; or, as we shall presently see, that death may really take place slowly, and yet be due to poison. This prejudice continually gives rise to the most unfounded suspicions of poisoning, and, at the same time, leads to cases of chronic or slow poisoning being frequently mistaken for natural disease. One of the means recommended for distinguishing narcotic poisoning from apoplexy or disease of the heart, is the difference in the rapidity with which death takes place. Thus, apoplexy or disease of the heart may prove fatal either instantly or within an hour. The only poisons likely to operate with such fatal rapidity are prussic and oxalic acids, strychnine, and nicotine. Poisoning by opium is commonly protracted for five or six hours. This poison has never been known to destroy life instantaneously, or within a few minutes. Thus, then, it may happen that death will occur with such rapidity as to render it impossible, under the circumstances, to attribute it to narcotic poison.

Chronic Poisoning.—When a poison destroys life rapidly, it is called a case of *acute* poisoning, to distinguish it from the *chronic* form, *i.e.* in which death takes place slowly. Chronic poisoning is a subject which has frequently required medico-legal investigation. Most poisons, when their effects are not rapidly manifested, owing either to the smallness of the dose or to timely treatment, are capable of slowly undermining the powers of life, and killing the patient by producing emaciation and exhaustion. This is sometimes observed in the action of arsenic, corrosive sublimate, and tartarated antimony; but it has been remarked also in cases of poisoning by the mineral acids and caustic alkalies. Death is here an indirect consequence: in poisoning by the acids or alkalies, either stricture of the gullet is induced, or the lining membrane of the stomach is destroyed, and the process of digestion impaired—a condition which leads to exhaustion and death. The time at which these indirect effects may prove fatal is, of course, liable to vary. A person has been known to die from a stricture of the gullet, brought on by sulphuric acid, *eleven months* after the poison was swallowed; and there is no reason to doubt that instances may occur of a still more protracted nature. In cases of *chronic poisoning*, there is sometimes great difficulty in assigning death exclusively to the original action of the poison, since the habits of life of the person, a tendency to disease, and other circumstances, may have concurred either to accelerate or produce a fatal result. To connect a stricture of the gullet, proving fatal, with the effects of poisoning by a mineral acid, it would be necessary to show that there was no tendency to this disease before the acid was administered; that the symptoms appeared soon after the first effects of the poison went off; that these symptoms continued to become aggravated until the time of death; and, lastly, that there was no other cause to which death could with any probability be referred. These remarks apply equally to the secondary fatal effects of any poison—such, for instance, as the salivation occasionally induced by corrosive sublimate, and the exhaustion and depression which are caused by tartarated antimony, when the acute symptoms of poisoning by these substances have passed away.

The characters of chronic poisoning have acquired a special interest for the medical jurist. There is a difficulty about them which no accuracy of observation or judgment can surmount. The poison or poisons, if found in the dead body at all, must usually exist in minute quantities only. This alone will be sufficient to create a doubt whether death has been caused by the poison, although it is quite consistent with medical experience that a person may die from chronic poisoning, and little or none of the poison be found in the body after death. In the case of *Mrs. James* (*Reg.* v. *Winslow*), not more than the tenth part of a grain of antimony was found in the whole of the tissues of the body: in the case of *Isabella Banks* (*Reg.* v. *Smethurst*, C. C. C., Aug., 1859), the quantity was greater than this, but less than a grain altogether; while in the case of *Mrs. Peters*, *none* was found in the body, although a chemist had extracted a quantity of antimony as sulphide from the urine of the deceased within less than nine days before her death. In this case antimony had also been found in the evacuations during life, and to the secret use of this mineral had been referred the intermittent irritation of the stomach and bowels, from which deceased had suffered. The jury returned a verdict that the deceased had died from disease, and that death was accelerated by some irritant. ('Lancet,' 1860, ii. p. 119.) On some trials for poisoning (*Reg.* v. *Palmer*, C. C. C., 1856; *Reg.* v. *Chantrelle*, High Ct. of Just. Edin., May, 1878) it has been a contested scientific question whether a person can die from poison and no trace of the poison remain in the body. The evidence in Mrs. Peters's case not only proves the affirmative, but goes to show that antimony may act fatally and be entirely eliminated from the system in about a week. ('Med. Times and Gaz.,' 1860, ii. pp. 190, 271, 317.)

2. *Evidence from the appearances in the body.*—One of the chief means of determining whether a person has died from poison, is an examination of the body after death. In relation to *external* appearances, there are none indicative of poisoning upon which we can safely rely. It was formerly supposed that the bodies of persons who were poisoned putrefied more rapidly than those of others who had died from natural disease; and evidence for or against poisoning was at one time derived from the external appearance of the body. This is now known to be an error: the bodies of persons poisoned are not more rapidly decomposed, *cæteris paribus*, than those of others who have died a sudden and violent death from any cause whatever.

Irritant poisons act chiefly upon the stomach and intestines, which they irritate, inflame, and corrode. We may likewise meet with all the consequences of inflammation, such as softening, thickening, ulceration, perforation, or gangrene. Sometimes the coats of the viscera are thickened, at other times thinned and softened, by the action of an irritant.

Neurotic poisons do not commonly leave any well-marked appearances in the body. The stomach and intestines may present no unnatural changes. There may be greater or less fulness of the vessels of the brain and spinal marrow, as well as of their membranes; but even this is often so slight as to escape notice, unless attention be particularly directed to these organs. Effusion of blood is rarely found.

It is important to bear in mind that both irritants and neurotics may destroy life without leaving any appreciable changes in the body. To such cases as these, the remarks about to be made do not apply. The proofs of poisoning must, in such exceptional cases, be procured entirely from other sources. Any evidence derivable from the appearances in the body of a person poisoned will be imperfect unless we are able to distinguish them from those analogous changes often met with as the results of ordinary disease. These are confined to the mucous membrane of the stomach and bowels. They are redness, ulceration, softening, and perforation. Each of these conditions may depend upon disease, as well as upon the action of irritant poisons.

Redness.—It is a main character of the irritants to produce, as a result of inflammation, redness of the mucous or lining membrane of the stomach and small intestines. This redness, when first seen, is usually of a deep crimson colour, becoming brighter by exposure to air. It may be diffused over the whole mucous membrane: at other times it is seen in patches, dots, or lines (striæ) spread irregularly over the surface of the stomach. It is sometimes met with at the smaller, but more commonly at the larger, end of this organ; and, again, we occasionally find the folds or prominences only of the mucous membrane presenting this red or inflamed appearance. Redness of the mucous membrane may, however, be due to gastritis, active digestion, the use of stimulants, or disease; and in order to assign the true cause of inflammation, it will be necessary to have an account of the symptoms preceding death, or some chemical proof of the existence of irritant poison in the contents of the stomach or in the tissues of the body.

In the healthy state, the mucous membrane of the stomach is pale and white, or nearly so, except during digestion, when it is slightly reddened; and redness has often remained in the stomachs of those who have died during the performance of the digestive process. When in contact with the spleen or liver, after death, the stomach is apt to acquire a deep livid colour from the transudation of blood; and it is well known that the bowels acquire a somewhat similar colour from the gravitation of blood which always takes place after death. In sudden death from valvular disease of the heart, the mucous membrane of the stomach is sometimes found intensely reddened. None of these appearances are likely to be mistaken for the action of an irritant poison.

There is an important class of cases in which redness of the mucous membrane of the stomach is found after death, not dependent on the action of poison or on any easily assignable cause. These cases, owing to their being so little known, and involved in much obscurity, deserve the attention of a medical jurist, since the appearances closely resemble those produced by irritant poison. A person may die without suffering from any symptoms of disordered stomach; but on an inspection of the body, a general redness of the mucous membrane of this organ will be found, not distinguishable from the redness which is so commonly seen in arsenical poisoning. Several cases of this kind have occurred; and drawings which have been made of the appearance presented by the stomach are preserved in the Guy's Hospital Museum.

The redness of the lining membrane of the stomach, in cases of poisoning, is so speedily altered by putrefaction, when circumstances are favourable to this process, as frequently to render it impossible for a witness to speak with any certainty upon its cause. Putrefactive infiltration of the blood contained in the adjacent viscera and muscles will give a reddish appearance to a stomach otherwise in a healthy condition. Great dispute has arisen respecting the length of time during which redness of the stomach produced by an irritant will be recognizable and easily distinguishable from putrefactive changes. It is sufficient to say that no certain rule can be laid down on the subject: it must be left to the knowledge and discretion of the witness. We have distinctly seen the well-marked appearances of inflammation produced by arsenic in the stomach and duodenum in exhumed bodies twenty-eight days and six months respectively after interment; and in another instance, the reddened state of the mucous membrane, in a case of arsenical poisoning, was plainly perceptible on removing a layer of arsenic *nineteen months* after interment. If, however, there should be a reasonable doubt respecting the cause of the redness, and no poison is detected, it would be unsafe to rely upon this appearance alone as evidence of poisoning. (See page 43, *ante.*)

Ulceration.—In irritant poisoning the stomach is occasionally found ulcerated; but this is, comparatively speaking, a rare occurrence. In such cases the mucous membrane is removed in small, distinct, circular patches, under the edges of which the poison (generally arsenic) may be found. Ulceration of the stomach is a more common result of disease than of the action of poison. As a consequence of disease, it is very insidious, going on often for weeks together, without giving any indications of its existence, except, perhaps, slight gastric disturbance, with occasional nausea, vomiting, and loss of appetite. In this case, the ulceration is commonly seen in small, circumscribed patches. It is worthy of remark, as a means of distinction, that ulceration has never been known to take place from arsenic or any irritant poison until symptoms indicative of irritant poisoning have occurred. In ulceration from disease, the mucous membrane is commonly reddened in the neighbourhood of the ulcer. In ulceration from poison, the redness is generally diffused over other parts of the stomach, as well as over the duodenum and small intestines. A case, however, occurred in Guy's Hospital, some years ago, in which, with a small, circular patch of ulceration near the cardiac opening, the whole mucous membrane was red and injected; but this singular condition of the stomach, so closely resembling the effects of an irritant poison, was unaccompanied by any marked symptoms of irritation during life. The history of a case previous to death will thus commonly enable us to determine to what cause the ulceration found may be due. Care must be taken to distinguish ulceration from *corrosion*. Ulceration is a vital process: the substance of a part is removed by the absorbents as a simple result of inflammation. Corrosion, on the other hand, is a chemical action: the parts are removed by the immediate contact of the poison; they are decomposed; their vitality is destroyed, and they combine with the corrosive matter itself. Ulceration requires time for its establishment, while corrosion is a very rapid effect.

Softening.—The coats of the stomach are not unfrequently found so soft as to yield and break down under very slight pressure; and this may be the result either of poisoning, of some spontaneous morbid change in its structure during life, or of the solvent action of the gastric juice after death. As this condition of the stomach, when caused by poison, is produced by those substances only which possess corrosive properties, it follows that, in such cases, traces of their action will be perceived in the mouth, throat, and gullet. In softening from disease, the change will be confined to the stomach alone, and it is commonly found only at the cardiac or greater end of the organ. When softening is really caused by an irritant poison, it is generally attended by other striking and unambiguous marks of its operation. Softening is not to be regarded as a common characteristic of poisoning: it is only an occasional appearance. Instances have been met with where the coats of the stomach were considerably hardened by sulphuric or, oftener, by carbolic acid. Softening can never be inferred to have proceeded from poison, unless other well-marked changes are present, or unless the poison is discovered in the softened parts. The stomachs of infants have been frequently found softened from natural causes: such cases could not be mistaken for poisoning, since the history of them during life, the want of other appearances indicative of poisoning, and the total absence of poison from the viscera, would prevent such a suspicion from being entertained.

Perforation.—The stomach may become perforated, either as a result of poisoning or of disease. *Perforation from poisoning.*—This may arise: 1, from corrosion; 2, from ulceration. The perforation by *corrosion* is by far the most common variety of perforation from poisoning. It is occasionally witnessed when a strong mineral acid has been taken, especially sulphuric acid; the stomach, in such cases, is blackened and extensively destroyed, the aperture is large, the edges are rough and irregular, and the coats are easily lacerated. The acid escapes into the abdomen, and may be detected there by chemical analysis. The perforation from *ulceration*, caused by irritant poison (arsenic), is but little known. There are but few instances on record. In a great number of poisoned subjects examined during many years past at Guy's Hospital, not a single case has occurred. It must, then, be looked upon as a rare appearance in cases of irritant poisoning. *Perforation from disease.*—This is by no means an unusual condition. Many cases of this disease will be found reported elsewhere. ('Guy's Hosp. Rep.,' ser. i., vol. iv., p. 8.) It is invariably fatal when it proceeds so far that the contents of the stomach escape into the abdomen; but sometimes the stomach becomes glued to the pancreas or other organs during the ulcerative process, and then the person may recover. Several instances of this kind of adhesion have been met with in inspections. The symptoms from perforation commonly attack a person suddenly, while apparently enjoying perfect health. Hence these cases may be easily mistaken for those of irritant poisoning. The principal facts observed with regard to this formidable disease are the following:—1. It often attacks young women from eighteen to twenty-three years of age. 2. The preceding illness is extremely slight; sometimes there is merely loss of appetite, or a capricious appetite, with uneasiness after eating. 3. The attack commences with a sudden and severe pain in the abdomen, generally soon after a meal. The pain usually comes on gradually in irritant poisoning, and slowly increases in severity. 4. Vomiting, if it exists at all, is commonly slight, and is chiefly confined to what is swallowed. There is no purging: the bowels are generally constipated. In irritant poisoning the vomiting is usually severe, and purging is seldom absent. 5. The person dies commonly in from eighteen to thirty-six hours: this is also a usual period of death in the most common form of irritant poisoning, *i.e.* by arsenic; but in no case yet recorded has arsenic caused perforation of the stomach within twenty-four hours, and it appears probable that a considerable time must elapse before such an effect could be produced by this or any irritant. 6. In perforation from disease the symptoms and death are clearly referable to peritonitis. 7. In the perforation from disease the aperture is commonly of an oval or rounded form, about half an inch in diameter, situated in or near the lesser curvature of the stomach, and the edges are smooth. The outer margin of the aperture is often blackened, and the aperture itself is funnel-shaped from within outwards; *i.e.* the mucous coat is the most removed, and the outer or peritoneal coat the least. The coats of the stomach, round the edge of the aperture, are usually thickened for some distance; and when cut they have almost a cartilaginous hardness. These characters of the aperture will not alone indicate whether it is the result of poisoning or disease; but the absence of poison from the stomach, with the want of other characteristic marks of irritant poisoning, would enable us to say that disease was the cause. Besides, the history of the case during life would materially assist us in our judgment. The great risk on these occasions is that the effects of disease may be mistaken for those of poisoning; for we are not likely to mistake a perforation caused by irritant poison for the result of disease. Notwithstanding the well-marked differences above described, it is common to meet with cases of imputed poisoning where death has really occurred from peritonitis following perforation. A case of this kind will be found elsewhere recorded. ('Guy's Hosp. Rep.,' 1850, p. 226.) In another the body was exhumed after several months' burial, and the stomach was found perforated from disease in the usual situation.

Spontaneous or Gelatinized Perforation.—The stomach is occasionally subject to a spontaneous change, by which its coats are softened, and give way, generally at the cardiac or greater end. As the effusion of the contents of the organ in such a case never gives rise to peritoneal inflammation, and no symptoms occur prior to death to indicate the existence of so extensive a destruction of parts, it is presumed to be a change in the dead body, and the coats of the stomach are supposed to undergo a process of solution or digestion. It is commonly attributed to the solvent action of the gastric juice, the spleen, diaphragm, and other viscera being sometimes softened. Wilks states that this post-mortem or cadaveric perforation of the stomach is so rare a condition that it is not met with once in five hundred cases. In the last two cases in which it was observed by him, one patient had died from albuminuria, and the other from head-affection; but in neither of these could there be found any peculiarities regarding their food, the time of the last meal, or the state of the bodies to account for the spontaneous destruction of the coats of the stomach. In January, 1845, the author met with an instance of this perforation in a child between two and three years of age. It was seized with convulsions, became insensible, and died twenty-three hours afterwards. After death, the greater end of the stomach was found destroyed to the extent of three inches; and the edges were softened and blackened. There was no food in the stomach, and nothing had passed into this organ for thirty-two hours before death. It was therefore impossible to ascribe death to the perforation, or the perforation to poison. ('Med. Gaz.,' vol. 36, p. 32.) An inspection of the body, with a general history of the case, will commonly suffice to remove any doubt in forming an opinion whether the extensive destruction, so commonly met with, has or has not arisen from poison. Thus, in a post-mortem perforation, the aperture is generally situated in that part of the stomach which lies to the left of the cardia; it is very large, of an irregular form, and ragged and pulpy at the edges, which have the appearance of being scraped. The mucous membrane of the stomach is not found inflamed. There is occasionally slight redness, with dark brown or almost black lines (striæ) in and near the dissolved coats, which have an acid reaction. It can only be confounded with perforation by the action of corrosives; but the well-marked symptoms during life, and the detection of the poison after death, together with the changes in the throat and gullet, will at once indicate the perforation produced by corrosive poison. Pavy has shown that after death the gastric juice dissolves the stomach.

CORROSIVE AND IRRITANT POISONS.

CHAPTER 7.

SULPHURIC ACID, OR OIL OF VITRIOL.—NITRIC ACID, OR AQUA FORTIS.—HYDROCHLORIC ACID.—SYMPTOMS.—APPEARANCES AND ANALYSIS.

Sulphuric Acid, or Oil of Vitriol.

Symptoms.—When this poison is swallowed in a concentrated form, the symptoms produced come on either *immediately* or during the act of swallowing. It has, however, been taken in mistake for a magnesian mixture, without the mistake being discovered till after the lapse of some time. There is violent burning pain, extending through the throat and gullet to the stomach, and the pain is often so severe that the body is bent. There is an escape of gaseous and frothy matter, followed by retching and vomiting; the latter accompanied by the discharge of shreds of tough mucus and of a liquid of a dark coffee-ground colour, mixed with blood. The vomited matters may contain shreds of mucous membrane from the gullet and stomach, and even portions of the muscular tissue of the former. These may form complete casts of some portions of the gullet or stomach. The mouth is excoriated, the lining membrane and surface of the tongue white, or resembling soaked parchment; and in one instance the appearance of the mouth was as if it had been smeared with white paint. After a time the membrane acquires a grey or brownish colour; the mouth is filled with a thick viscid substance consisting of saliva, mucus, and the corroded membrane; this renders speaking and swallowing difficult. If the poison has been administered by a spoon, as in infants, or the phial containing it has been passed to the back of the throat, the mouth may escape the chemical action of the acid, and a child will not always scream under such circumstances. Around the lips and on the neck may be found spots of a brown colour from the spilling of the acid and its action on the skin. There is great difficulty of breathing, owing to the swelling and excoriation of the throat and larynx; and the countenance has from this cause a bluish or livid appearance. The least motion of the abdominal muscles is attended with increase of pain. The stomach is so irritable that whatever is swallowed is immediately ejected, and the vomiting is commonly violent and incessant. The matters *first* vomited generally contain the poison: they are acid, and, if they fall on a limestone pavement, there is effervescence; if on coloured articles of dress, the colour is sometimes altered to a red or yellow, or it is entirely discharged and the texture of the stuff destroyed; on a black cloth dress, the spots produced by the concentrated acid are reddish brown, and remain moist for a considerable time. After a time there is exhaustion, accompanied by great weakness; the pulse becomes quick, small, and feeble; the skin cold, mottled, and covered with a clammy sweat. There is generally great thirst, with obstinate constipation of the bowels; should any evacuations take place, they are commonly either of a dark brown or leaden colour, and in some instances almost black from an admixture of altered blood. There are sometimes convulsive motions of the muscles, especially those of the face and lips. The countenance, if not livid from obstructed respiration, is pale, and expressive of great anxiety and intense suffering. The intellectual faculties are quite clear; and death usually takes place very suddenly, in from eighteen to twenty-four hours after the poison has been taken. *Sulphate of indigo* produces similar symptoms. The vomited matters are, however, bluish black.

Appearances after Death.—The appearances met with in the body of a person who has died from the effects of this acid vary, according to whether death has taken place rapidly or slowly. Supposing the case to have proved rapidly fatal, the membrane lining the mouth may be found white, softened, and corroded. The mucous membrane of the throat and gullet is commonly found corroded, having a brown-black or ash-grey colour, and blood is effused in patches beneath it. The corroded membrane of the gullet is occasionally disposed in longitudinal folds, portions of it being partly detached. The stomach, if not perforated, is collapsed and contracted. On laying it open, the contents are commonly found of a dark brown or black colour and of a tarry consistency, being formed in great part of mucus and altered blood. The contents may or may not be acid, according to the time the patient has survived, and the treatment which has been adopted. On removing them, the stomach may be seen traversed by black lines, or the whole of the mucous membrane may be stained black or of a dark brown colour. On forcibly stretching the coats, the red colour indicative of inflammation may be sometimes seen in the parts beneath, or surrounding the blackened portions.

When the stomach is perforated, the coats are softened, and the edge of the aperture is commonly black and irregular. In removing the stomach, the opening is liable to be made larger by the mere weight of the organ. The contents do not always escape; but, when this happens, the surrounding parts are attacked by the poison. In one case the spleen, the liver, and the coats of the aorta were found blackened and corroded by the acid, which had escaped through the perforation. In some rare cases the lining membrane of the aorta has been found strongly reddened. When a person has survived for eighteen or twenty hours, traces of corrosive and inflammatory action may be found in the small intestines. In one case the mucous membrane of the ileum was corroded. The interior of the windpipe, as well as of the bronchial tubes, has also presented marks of the local action of the acid. The acid has thus destroyed life without reaching the stomach. A remarkable instance in which the poison penetrated into and destroyed both lungs has been reported. ('Med. Gaz.,' vol. 45, p. 1102.) It is important for a medical witness to bear in mind that the mouth, throat, and gullet are not always found in the state above described. Ogle met with a case in which the membrane of the tongue was but slightly affected.

Fatal Dose.—The dangerous effects of sulphuric acid appear to arise rather from its degree of concentration than from the absolute quantity taken. The quantity actually required to prove fatal must depend on many circumstances. If the stomach is full when the poison is swallowed, the action of the acid may be spent on the food and not on the stomach; and a larger quantity might then be taken than would suffice to destroy life if the organ were empty. The smallest quantity which is described as having proved fatal was in the following case. Half a teaspoonful of concentrated sulphuric acid was given to a child about a year old by mistake for castor oil. The usual symptoms came on, with great disturbance of breathing; and the child died in twenty-four hours. The quantity here taken could not have exceeded *forty drops.* ('Med. Gaz.,' vol. 29, p. 147.) It is, however, doubtful whether this small quantity would have proved fatal to an adult. The smallest fatal dose which Christison states he has found recorded is *one drachm;* it was taken in mistake by a young man, and killed him in seven days. ('On Poisons.') Even when diluted, the acid will destroy life rapidly. A man swallowed, on an empty stomach, six drachms of the strongest acid diluted with eighteen drachms of water. He suffered from the usual symptoms, and died in two hours and a half. ('Med. Times and Gaz.,' 1863, 1, p. 183.)

Fatal Period.—The average period at which death takes place in cases of acute poisoning by sulphuric acid, is from eighteen to twenty-four hours. The shortest case recorded occurred to Rapp. A man, æt. 50, swallowed three ounces and a half of concentrated sulphuric acid; he died in *three quarters of an hour.* ('Gaz. Med.,' Dec. 28, 1850.) On the other hand, there are numerous instances reported in which the poison has proved fatal, from secondary causes, at periods varying from one week to several months, and even years.

Chemical Analysis.—If the acid is in a pure state and *concentrated,* it possesses these properties: 1. Wood, sugar, or other organic matter plunged into it, is speedily carbonized or charred, either with or without the application of heat. 2. When boiled with wood, copper-cuttings, or mercury, it evolves fumes of dioxide of sulphur; this is immediately known by the odour, as well as by the vapour first rendering blue, and then bleaching, starch-paper dipped in a solution of iodic acid. 3. When mixed with an equal bulk of water, great heat is evolved.

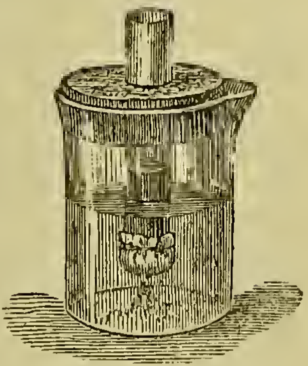
Sulphuric acid when *diluted* does not carbonize organic substances. If, however, a glass rod be dipped in the diluted acid, and a mark be made with this upon writing-paper, and the paper be then gently dried before a fire, a black mark will be left wherever the acid has touched the paper. This test is applicable to organic liquids containing sulphuric acid. One test only is required for its detection, namely, a solution of a salt of barium—either the *nitrate*, or the *chloride of barium.* Having ascertained by test-paper that the suspected liquid is acid, and contains a free mineral acid (see below), we add to a portion of it a few drops of nitric acid, and then a solution of barium salt. If sulphuric acid is present, a dense white precipitate of the sulphate of barium will fall down: this is insoluble in all acids and alkalies. If the precipitate is collected, dried, and heated to full redness for some minutes, in a platinum crucible, or in a folded piece of platinum foil, with five or six parts of charcoal powder, it will, if a sulphate, be converted into sulphide of barium. To prove this, we add to the calcined residue hydrochloric acid, at the same time suspending over it a slip of filtering-paper moistened with a solution of acetate of lead. If the precipitate obtained is a sulphate, the gas evolved will be sulphuretted hydrogen, known by its odour, and by its turning a salt of lead of a brown colour.

Cyanide of potassium may be used as a reducing agent in place of charcoal, in a proportion of one part to three parts of the sulphate of barium. The mixture should be heated to fusion in a reduction-tube. On breaking the glass when cold, and laying the incinerated residue on paper or card wetted with a salt of lead, a brown stain indicative of sulphide of lead is produced; or the residue may be dissolved in water, and a solution of acetate of lead added to it.

In liquids containing organic matter.—If sulphuric acid is mixed with such liquids as porter, coffee, or tea, the process for its detection is substantially the same, the liquid being first rendered clear by filtration. The precipitated sulphate of barium, if mixed with organic matter, may be purified by boiling it in strong nitric acid; but this is not commonly necessary, as the reduction of the dried precipitate may be equally well performed with the impure as with the pure sulphate. Some liquids, such as vinegar, porter, and most wines, generally contain a soluble sulphate, but in small proportion; therefore, if there is an abundant precipitate, there can be no doubt, *cæteris paribus*, that free sulphuric acid has been added to them. The liquid should invariably be tested for the presence of a *free* or uncombined mineral acid. Ferric acetate is mixed with solution of potassium sulpho-cyanate, and diluted till the colour is a very pale red. A drop or two of the suspected liquid dropped into this solution will yield blood-red streaks if a free mineral acid be present. An alcoholic solution of methyl-violet is rendered blue when 1-4000th of a free mineral or oxalic acid is present. Should the liquid be thick and viscid, like gruel, it may be diluted with water, and then boiled with the addition of a little acetic acid. The coats of the stomach should be cut up and boiled in distilled water. For the action of the barium test, it is not necessary that the liquid should be absolutely clear, provided it is not so thick as to interfere mechanically with the precipitation of the sulphate of barium.

Dialysis.—When the acid is mixed with milk, decomposed blood, mucus, or other substances, rendering it thick and viscid, it may be readily separated by dialysis—a process which is applicable to the other acid poisons, such as nitric, hydrochloric, and oxalic. A portion of the acid viscid liquid should be placed in a test-tube, about five inches long, and one inch in diameter, open at both ends; the neck being securely covered with a layer of thin bladder or parchment-paper. The tube is then immersed, mouth downwards, in a beaker containing distilled water (Fig. 1). After some hours the acid will pass through the membrane, and may be detected in the water. This process may be employed as a trial test of the contents of the stomach when they have a strongly acid reaction. In thus testing for sulphuric acid it must be remembered that a sulphate, like Epsom salts, may be present in the liquid; and that an innocent acid, like vinegar or lemon-juice, may give the acid reaction. To remove any fallacy on this ground, a portion of the liquid tested should be evaporated, and the residue incinerated, when the alkaline sulphate, if present, will be obtained in the form of a solid.

Fig. 1.



Beaker and tube for the dialysis of liquid poisons.

It is a medico-legal fact of considerable importance, that the contents of a stomach in a case of poisoning by sulphuric acid are sometimes entirely free from any traces of this poison, even when it has been swallowed in large quantity. Casper relates three such cases. The acid is not commonly found when the person has been under treatment; when there has been considerable vomiting, aided by the drinking of water or other simple liquids; or when he has survived several days.

Sulphuric acid may be detected on *articles of clothing* by a similar process. The concentrated acid produces brown stains on black cloth—the spots remain damp, and the fibre of the stuff is gradually softened and corroded. The stained portion of cloth should be boiled in water, and the solution filtered, tested for free acid (see p. 74, *ante*), and then with a salt of barium. If any free acid is present, the stained stuff and the solution obtained from it will redden litmus-paper. Sometimes the detection of the acid on clothing is the only source of chemical evidence in cases of poisoning. It has been thrown on the person for the purpose of producing bodily injury or injury to the clothes. In such cases it must be proved that the substance is of a corrosive nature, but it is not necessary to show that injury has been done to the person. The *acid sulphates*, such as alum, act as irritant poisons when given in large doses. Tardieu, who gives the details of two cases of fatal poisoning by alum ('L'Empoisonnement,' p. 218), is of opinion that from half an ounce to an ounce of the salt is a fatal dose for an adult.

Nitric Acid, or Aqua Fortis.

Symptoms.—When nitric acid is taken in a concentrated state, the symptoms bear a close resemblance to those produced by sulphuric acid. They come on *immediately*, and the swallowing of the acid is accompanied by intense burning pain in the throat and gullet, extending downwards to the stomach: there are gaseous eructations, resulting from the chemical action of the poison, swelling of the abdomen, violent vomiting of liquid or solid matters, mixed with altered blood of a dark brown colour, and shreds of yellowish-coloured mucus, having a strongly acid reaction. The abdomen is generally exquisitely tender; but, in one well-marked case of poisoning by this acid, the pain was chiefly confined to the throat: probably the poison had not reached the stomach. The mucous membrane of the mouth is commonly soft and white, after a time becoming yellow, or even brown; the teeth are also white or yellow, and the enamel is partially destroyed by the chemical action of the acid. There is great difficulty of speaking and swallowing, the mouth being filled with viscid mucus; the power of swallowing is, indeed, sometimes entirely lost. On opening the mouth, the tongue may be found swollen, and of a citron colour; the tonsils are also swollen and enlarged. As the symptoms progress, the pulse becomes small, frequent, and irregular—the surface of the body cold, and there are frequent rigors (shivering). The swallowing of liquids increases the severity of the pain and occasions vomiting. There is obstinate constipation. Death takes place in from eighteen to twenty-four hours, and is sometimes preceded by a kind of stupor, from which the patient is easily roused. The intellectual faculties commonly remain clear until the last. Death may occur from pneumonia, the fumes of the acid having gained access to the lungs.

The *vapour* of this acid is destructive to life. In 1854 *Mr. Haywood*, a chemist of Sheffield, lost his life under the following circumstances: he was pouring a mixture of nitric and sulphuric acids from a carboy containing about sixty pounds, when by some accident the vessel was broken. For a few minutes he inhaled the fumes of the mixed acids, but it does not appear that any of the liquid fell over him. Three hours after the accident he was sitting up and appeared to be in moderately good health. He was then seen by a medical man, and complained merely of some cuts about his hands. He coughed violently. In three hours more there was difficulty of breathing, with increase of the cough. There was a sense of tightness at the lower part of the throat, and the pulse was hard. At times he said he could scarcely breathe. He died eleven hours after the accident. On inspection, there was congestion of the windpipe and bronchial tubes, with effusion of blood in the latter. The heart was flaccid, and contained but little blood; and the lining membrane of the heart and aorta was inflamed. The blood gave a slightly acid reaction with test-paper. The windpipe was not examined. It is very probable the seat of mischief was in this organ, and that the deceased died from inflammatory effusion and swelling of the parts about the opening of the windpipe. ('Lancet,' 1854, i. p. 430.) A similar accident occurred to *Mr. Stewart* and one of the janitors of an educational institution in Edinburgh, in 1863. They both died from the effects of the acid vapour. ('Chem. News,' 1863, p. 132.)

The fumes from batteries charged with nitric acid are often productive of serious results; and the editor has met with alarming illness arising from the inhalation of the nitrous fumes given off during the working of such batteries in an ill-ventilated room.

Appearances after Death.—Supposing death to have taken place rapidly from the liquid acid, the following appearances may be met with. The skin of the mouth and lips will present various shades of colour, from an orange-yellow to a brown. Yellow spots produced by the spilling of the acid may be found about the hands and neck. The membrane lining the mouth is sometimes white—more commonly of a citron colour; and the teeth are white or yellowish in colour. The throat and windpipe are much inflamed. The lining membrane of the gullet is softened, of a yellow or brown colour, and easily detached, often in long shreds. The windpipe is congested, and the lungs also. The most strongly marked changes are seen in the stomach. When not perforated, this organ may be found distended with gas, its mucous membrane partially inflamed and covered with patches of a yellow, brown, or green colour, or it may be even black. Its coats may be so much softened as to break down under the slightest pressure. Similar changes are found in the duodenum; but in some cases the small intestines have presented no other appearance than that of a slight redness. It might be supposed that the stomach would be in general perforated by this corrosive liquid; but perforation has not been often observed. In a case of the editor's, there was a small aperture in the anterior wall of the stomach, around which the peritoneum was ecchymosed; but no lymph was exuded around the opening. It is probable that the rupture had taken place about the time of death, which supervened seventeen hours after the acid was taken. ('Guy's Hosp. Rep.,' 1872, xvii. p. 223.) In a case which proved fatal after the long period of six months, there was, at the intestinal end of the stomach, a distinct cicatrix with puckering and hardening of the surrounding mucous membrane, causing a slight contraction of the intestinal orifice. The only other appearance consisted in some dark longitudinal lines on the posterior surface of the lining membrane of the gullet. This had probabiy been caused by the acid. ('Lancet,' 1860, ii. p. 510.)

The *smallest* quantity of this acid which is reported to have destroyed life, is about *two drachms.* It was in the case of a boy, aged thirteen: he died in thirty-six hours. Death commonly takes place within twenty-four hours. Sobernheim relates a case of poisoning by nitric acid, which proved fatal in *one hour and three quarters.* This is believed to be the most rapidly fatal instance on record, where the acid acted in the ordinary manner. The usual well-marked effects were found in the gullet, stomach, and small intestines. In infants, life may be destroyed by this poison in a few minutes, should it happen to reach the larynx. The longest case is, perhaps, that recorded by Tartra, where a woman died from exhaustion, produced by the secondary effects of the acid *eight months* after having swallowed it.

Chemical Analysis.—In the simple state.—This acid may be met with either concentrated or diluted. The *concentrated acid* varies in colour from a deep orange-red to a light straw-yellow. It may be recognized:

1. By evolving acid fumes when exposed to the air or when heated. 2. By its staining organic matter yellow or brown, the colour being heightened and turned to a reddish tint by contact with caustic alkalies. 3. When mixed with a few copper cuttings, it is rapidly decomposed, deep red acid vapours are given off, and a greenish coloured solution of nitrate of copper is formed. Tin or mercury may be substituted for copper in this experiment. 4. The addition of gold-leaf and a few drops of hydrochloric acid : if nitric acid is present, the gold will be dissolved on warming the mixture. Common aqua fortis (nitric acid) sometimes contains, as impurity, a sufficiency of hydrochloric acid to dissolve gold-leaf by heat. It strikes a deep brown colour with a solution of ferrous sulphate. *In the diluted state.*—This acid is not precipitated like sulphuric, by any common reagent, since all its saline combinations are soluble in water. 1. The liquid has a highly acid reaction, and (if not too diluted), on boiling it with some copper turnings, red fumes are given off, the liquid acquiring a blue colour at the same time. 2. A streak made on white paper with the diluted acid does not carbonize it when heated; but a scarcely visible yellow stain is left. 3. The liquid is neither precipitated by nitrate of barium nor by nitrate of silver. These last two experiments give merely negative results; they serve to show that sulphuric and hydrochloric acids are absent. 4. The liquid is mixed with an equal bulk of pure sulphuric acid, partially cooled, and then a solution of ferrous sulphate is gently poured on to the surface of the mixture: a deep brown ring forms at the junction of the two liquids if nitric acid or a nitrate be present.

In order to detect nitric acid when mixed with water or other liquids, the liquid should be first tested with litmus-paper, and also with ferric acetate and potassium sulpho-cyanate, or by means of methyl-violet, for the presence of a free mineral acid (see p. 74, *ante*). Two separate portions should then be carefully neutralized—the one with potash, the other with soda, and then each slowly evaporated to obtain crystals. If the liquid contains nitric acid, these crystals will have the following characters:—1. Those of potassium nitrate appear in the form of lengthened fluted prisms, which neither effloresce nor deliquesce on exposure to air. Those of sodium nitrate have a rhombic form, and closely simulate the appearance of the cubic crystals of common salt. One drop of the solution, evaporated spontaneously on glass, will suffice to yield distinct and well-formed crystals. 2. When moistened with strong sulphuric acid, the powdered crystals of either salt slowly evolve a colourless acid vapour. By this test the nitrate is known from every other deflagrating salt. 3. A portion of the powdered crystals should be placed in a small tube and mixed with their bulk of fine *copper* filings. The mass is then to be moistened with water, and a few drops of strong *sulphuric acid* added. Either with or without the application of a gentle heat, decomposition immediately ensues, by which red *nitrous fumes* are evolved, recognizable by their colour, odour, and acid reaction. In operating on a small quantity of nitrate free from chloride, the crystals may be placed in a flask and mixed with one or two drops of concentrated sulphuric acid and a few copper filings. Place in the neck of the flask a slip of damp blue litmus-paper, and a slip of starch-paper moistened with a solution of iodide of potassium. After a longer or shorter interval the litmus will be reddened, and the starch-paper will assume a blue-black colour. If the nitrate should be mixed with much chloride, then the power of dissolving gold-leaf on boiling the dry salt with strong hydrochloric acid furnishes the best means of detection. 4. We add to the crystals a small portion of gold-leaf and hydrochloric acid; then boil for a few minutes. If nitric acid or a nitrate is present, the gold will either partly or entirely disappear. Its partial solution will be indicated by a dark purple or brown colour on the addition of stannous chloride to the liquid after boiling.

In liquids containing organic matter.—Nitric acid may be administered in such liquids as tea, vinegar, or porter. In this case, besides the acid reaction, there will be a peculiar smell produced by the strong acid, when mixed with organic substances. The application of the usual tests may be here counteracted: thus, unless the quantity of nitric acid in the liquid is considerable, the orange-red nitrous acid fumes are not evolved on boiling it with copper cuttings.

The action on gold-leaf will enable a chemist to detect nitric acid in coffee, tea, and similar organic liquids, even when the proportion of acid is small. Boil a fragment of gold-leaf in pure hydrochloric acid, and add while boiling a few drops of the suspected organic liquid to the mixture. If the acid is present, the gold will be dissolved. When the acid liquid is thick and turbid, a portion of it should be placed in a tube and submitted to the process of dialysis (see p. 74, *ante*). Vomited matters, as well as the contents and coats of the stomach (cut up), should be boiled in water, and filtered. If not cleared by filtration, they may be submitted to dialysis, and the acid water obtained carefully neutralized with potash or soda and concentrated. If by filtration we succeed in procuring a clear acid liquid, the colour is of no importance. A few drops of the neutralized and concentrated liquid may be evaporated on a glass slide, and the crystals thus obtained examined microscopically and compared with those of nitrate of potassium or sodium. Paper dipped into the concentrated liquid and dried burns with deflagration like touch-paper. The crystals obtained by evaporating the neutralized liquid are generally coloured with organic matter, but they fuse into a white mass when heated in a platinum capsule. The pure nitrate thus obtained may be tested as above described. The organic matter in the crystals does not interfere with the results of the copper and gold tests.

When either nitric acid, or the nitrate into which it has been converted, is mixed with common salt, the copper test cannot be employed. The gold test will in such a case furnish the best evidence. Hydrochloric acid with a small portion of gold-leaf may be added to the dried residue, and the mixture boiled. If nitric acid or a nitrate is present, even in minute proportion, some portion of the gold will be dissolved—a fact demonstrable by the addition of stannous chloride.

Nitric acid may be detected in *stains on clothing*, if recent, by simply boiling the stained cloth in water. An acid liquid will be obtained, unless the stains are of old date or the stuff has been washed. This liquid, when concentrated, may be dealt with in the manner already described for organic liquids. The stains from this acid on black and blue cloth are of a yellow or brownish-yellow colour and are indelible. When long exposed they become dry, but the cloth is easily torn. A simple method of detecting the acid is to boil at once a piece of the stained cloth with a fragment of gold-leaf and hydrochloric acid. If nitric acid is present in the stain, a portion of the gold will be dissolved.

Hydrochloric Acid. Muriatic Acid.

This acid, which is also called muriatic acid, and is popularly known under the name of spirit of salt, is often taken as a poison. In the cases which have been hitherto observed, the *symptoms* and *appearances* have been similar to those caused by nitric acid. A woman, æt. 63, swallowed *half an ounce* of concentrated hydrochloric acid. She was received into the hospital in three quarters of an hour. The prominent symptoms were burning pain in the throat and stomach, feeble pulse, cold and clammy skin, retching, and vomiting of a brown matter streaked with blood and containing shreds of membrane. There was great exhaustion. The throat became swollen, the patient lost the power of swallowing, and died in eighteen hours. She retained her senses until the last. The *appearances* in the body were as follows: The mucous membrane of the mouth and throat was white, softened, and destroyed in many places by the corrosive action of the acid. The membrane of the gullet was red and inflamed. The back part of the stomach near the pylorus was dark-coloured, stripped of its mucous membrane (which was generally softened), and marked with black lines. It was not perforated. ('Lancet,' 1859, ii. p. 59.) In this case the smallest quantity of hydrochloric acid was taken which has as yet been known to prove fatal.

In 1885, a man, æt. 37, was admitted into Guy's Hospital after swallowing, for suicidal purposes, a fluid ounce of strong hydrochloric acid, in which he had dissolved a dram of oxalic acid. The ordinary antidotes were employed, and he progressed favourably till the tenth day, when he died rather suddenly. On post-mortem examination the editor found a membranous exudation at the back of the pharynx, and minute ulcers. The mucous membrane of the gullet was white, thickened, and interspersed with small extravasations of blood. The stomach contained remains of food, of the ordinary acidity. The mucous membrane was white, and mammillated. Towards the pyloric or intestinal end there were small ulcers with open blood-vessels, from the mouths of which extended considerable extravasations of blood blackened by the action of the acids of the stomach. Between the ulcers the surface was raw and hemorrhagic. The hemorrhage extended into the duodenum, but not beyond.

Chemical Analysis.—In a *concentrated* state, hydrochloric acid evolves copious fumes. The pure acid is nearly colourless; the commercial acid is of a lemon-yellow colour, and frequently contains iron, arsenic, common salt, and other impurities. When boiled with a small quantity of peroxide of manganese, chlorine is evolved. It does not dissolve gold-leaf until a few drops of nitric acid have been added to it and the mixture is heated. In the *diluted* state, it may be recognized by the dense white precipitate which it gives when a solution of nitrate of silver is added to it. This precipitate is insoluble in nitric acid, but soluble in ammonia; it becomes purple when exposed to light; and when heated it melts without decomposition, forming a yellowish-coloured substance on cooling. If the acid is contained in organic liquids in moderate quantity, it admits of separation by distillation to dryness. In this case any chlorides present are left in the retort. It may also be procured by dialysis in a pure enough state for testing (see p. 74, *ante*). In all cases the presence of a free mineral acid must be ascertained (see p. 74, *ante*).

Hydrochloric acid, in small quantity, as well as alkaline chlorides, are natural constituents of the fluids of the stomach and bowels. The presence of local chemical changes in the throat and stomach would show whether the acid had been taken as a poison. If the acid is found only in minute quantity, no inference of poisoning can be drawn, unless there are distinct marks of its chemical action upon the throat and stomach. It darkens the blood like sulphuric acid, although it has not the same degree of carbonizing action on organic matter. The *stains* produced by this acid on black cloth are generally of a reddish colour. As the acid is volatile, it may disappear from the stuff. If recent, the acid may be separated by boiling the stuff in water and applying the silver test, and the tests for a free mineral acid (see p. 74, *ante*). An unstained portion of cloth should be similarly tested for the sake of comparison.

CHAPTER 8.

OXALIC ACID.—SYMPTOMS AND APPEARANCES.—CHEMICAL ANALYSIS.—DIALYSIS OF ORGANIC LIQUIDS.—ACID OXALATE OF POTASSIUM, OR SALT OF SORREL.—VEGETABLE ACIDS.

Oxalic Acid.

Symptoms.—If this poison is taken in a large dose, *i.e.* from half an ounce to an ounce of the crystals, dissolved in water, a hot burning acid taste is experienced during the act of swallowing the poison. This is accompanied by a similar sensation extending down the gullet to the stomach. There is sometimes a sense of constriction or suffocation; the countenance is livid, and the surface of the skin soon becomes cold and clammy. Vomiting occurs either immediately or within a few minutes. Should the poison be much diluted, there is merely a sensation of strong acidity, and vomiting may not occur until after a quarter of an hour or twenty minutes. In some cases there has been little or no vomiting, while in others this symptom has been incessant until death. In one case, in which an ounce of the acid was swallowed, the vomiting with pain in the stomach continued until the fifth day, when the man died suddenly ('Lancet,' 1860, ii. p. 509); but in another, in which the poison was much diluted, vomiting did not occur for seven hours. (Christison.) The vomited matters are highly acid, have a greenish-brown or almost black colour, and consist chiefly of mucus and altered blood. The patient complains of great pain and tenderness in the abdomen, with a burning sensation in the stomach. There may be convulsions. There is in general an entire prostration of strength, so that if the person is in the erect position, he falls; there is likewise unconsciousness of surrounding objects, and a kind of stupor, from which, however, the patient may be without difficulty roused. Owing to the severity of the pain, the legs are sometimes drawn up towards the abdomen, or the patient rolls about on the floor or bed. The pulse is small, irregular, and scarcely perceptible; the skin cold and clammy; and there is a sensation of numbness in the limbs, with spasmodic breathing. The inspirations are deep, and a long interval elapses between them. Should the patient survive the first effects of the poison, the following symptoms may appear: soreness of the mouth, constriction and burning pain in the throat, pain in swallowing, tenderness in the abdomen, and irritability of the stomach, so that there is frequent vomiting, accompanied by purging. The tongue is swollen, and there is great thirst. Sometimes there is aphonia, or the patient speaks in a feeble *punchinello* voice. The following case is exceptional, from the fact that the symptoms throughout were chiefly referable to the brain. A man took what was supposed to be a black draught, but it contained oxalic acid instead of Epsom salts. Two hours afterwards he was found in a state of complete coma, but the symptoms set in in a quarter of an hour after he had taken the draught. The man died in five hours, without recovering his consciousness. The only marked appearance on inspection was intense congestion of the brain. ('Lancet,' 1872, ii. p. 41.) Oxalic acid injected into the circulation of animals acts as a cardiac poison; and this is in accordance with its well-known rapidly fatal effects on man. Christison says, 'If a person, immediately after swallowing a solution of a crystalline salt, which tasted purely and strongly acid, is attacked with burning in the throat, then with burning in the stomach, vomiting, particularly of bloody matter, imperceptible pulse, and excessive languor, and dies in half an hour, or, still more, in twenty, fifteen, or ten minutes, I do not know any fallacy which can interfere with the conclusion that oxalic acid was the cause of death. No parallel disease begins so abruptly, and terminates so soon; and no other crystalline poison has the same effect.' Ringer asserts that soluble oxalates precipitate calcium from the blood as insoluble calcium oxalate; and as soluble calcium salts in the blood are requisite for the maintenance of the muscular contractility, oxalates may kill by destroying the cardiac muscular contractility. ('Practitioner,' 1885, xxxiv. p. 81.)

Appearances after Death.—The mucous membrane of the tongue, mouth, throat, and gullet is softened, and commonly white as if bleached; but it is sometimes coated with a portion of the brown mucous matter discharged from the stomach. This latter organ contains a dark brown mucous liquid, often acid, and having almost a gelatinous consistency. On removing the contents, the mucous membrane will be seen pale and softened, without always presenting marks of inflammation or abrasion, if death has taken place rapidly. The membrane is white, soft, and brittle, easily raised by the scalpel, and presents the appearance which we might suppose it would assume after having been for some time boiled in water. The small vessels are seen ramifying over the surface, and filled with dark-coloured blood apparently solidified within them. The lining membrane of the gullet presents the same characters, and has often a worm-eaten appearance. It is pale, and appears as if it had been boiled in water, or digested in alcohol; it has been found strongly raised in longitudinal folds, interrupted by patches were the membrane has become abraded. In a case which was fatal in eight hours, the tongue was covered with white specks; the gullet was not inflamed, but the stomach was extensively destroyed, and had a gangrenous appearance. Portions of the mucous membrane were detached, exposing the muscular coat. With respect to the intestines, the upper portion may be found inflamed; but, unless the case is protracted, the appearances in the bowels are not strongly marked.

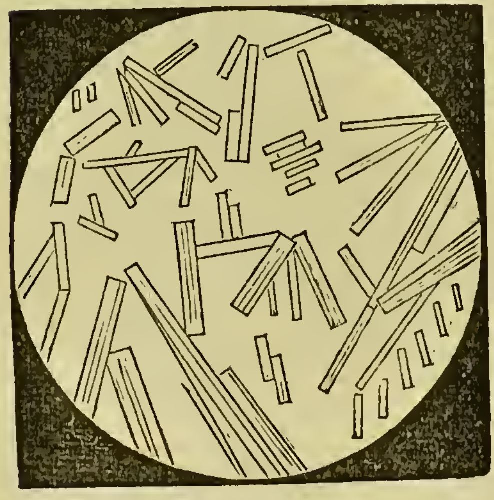
In a well-marked instance of poisoning by this acid, which is recorded by Hildebrand, the mucous or lining membrane of the stomach and duodenum was much reddened, although the patient, a girl of eighteen, died in three-quarters of an hour after taking one ounce of the acid, by mistake for Epsom salts. (Casper's 'Vierteljahrsschr.,' 1853, p. 256.) In a case of poisoning in which two ounces of the acid had been taken, and death was rapid, the coats of the stomach presented almost the blackened appearance produced by sulphuric acid, owing to the colour of the altered blood spread over them. In protracted cases, the gullet, stomach, and intestines have been found more or less congested or inflamed. In the case already cited, in which an ounce was swallowed, and death occurred on the fifth day, the stomach was slightly congested, and contained a bloody fluid, but the mucous membrane was entire. ('Lancet,' 1860, ii. p. 509.)

The glairy contents of the stomach do not always indicate strong acidity until after they have been boiled in water. Oxalic acid does not appear to have so strongly corrosive an action on the stomach as that possessed by the mineral acids. It is, therefore, rare to hear of the coats of the organ being perforated by it. The acid, when in a concentrated state, renders the mucous coat soft and brittle, and perforation of the coats may occur either during life or after death as a result of its chemical action. Wood has recorded the case of a woman, æt. 27, found dead, whose death had been obviously caused by oxalic acid, but the quantity taken, and the duration of the case, were unknown. The stomach presented, at its upper and fore part near the cardiac opening, an irregular aperture of a size to admit the point of the finger.

The smallest quantity of this poison which has been said to destroy life is *one drachm* (60 grains). The boy, æt. 16, took that quantity, as he said, of the poison in a solid form, and was found in about an hour insensible, pulseless, and his jaws spasmodically closed. He had vomited some bloody matter; his tongue and lips were unusually pale, but there was no excoriation. He died in eight hours. ('Lancet,' 1855, ii. p. 521.) Tardieu ('L'Empoisonnement,' p. 253) speaks of a fatal case in a young man, æt. 16, from a dose of 30 grains (2 grammes), but it is doubtful, since he gives no details, whether this is not the English case just now mentioned. Two cases occurred at Guy's Hospital, in each of which half an ounce of oxalic acid had been swallowed. Active treatment was adopted, and both patients recovered. When the dose of oxalic acid is half an ounce and upwards, death commonly takes place within an hour; but there are numerous exceptions to this rapidity of action. Christison mentions an instance in which an ounce of oxalic acid killed a girl in thirty minutes; and another in which the same quantity destroyed life in *ten minutes*; but in a third case death did not occur until the fifth day. Ogilvy has reported a case of poisoning by oxalic acid in which it is probable that death took place within *three minutes* after the poison had been swallowed. The quantity of the acid taken could not be determined.

Chemical Analysis.—In the simple state.—This acid may be met with, either as a solid or in solution in water. *Solid oxalic acid:* It crystallizes in long slender prisms, which, when perfect, are four-sided (Fig. 2). In this respect it differs from other common acids, mineral and vegetable. The crystals are unchangeable in air, and to the eye are precisely like those of Epsom salts; they are soluble in water and alcohol, forming strongly acid solutions. When heated on platinum-foil they melt, and are entirely dissipated without blackening. Heated in a close tube, they melt, and the vapour is condensed as a white crystalline sublimate in a cold part of the tube. There should be no residue whatever if the acid is pure, but the commercial acid generally leaves a slight residue of fixed impurity. By this effect of heat, oxalic acid is easily distinguished from those crystalline salts for which it has been sometimes fatally mistaken, namely, the sulphates of magnesium and zinc. These leave white residues in the form of anhydrous salts. A teaspoonful of oxalic acid in small crystals weighs seventy-

Fig. 2.



Crystals of Oxalic Acid, magnified 30 diameters.

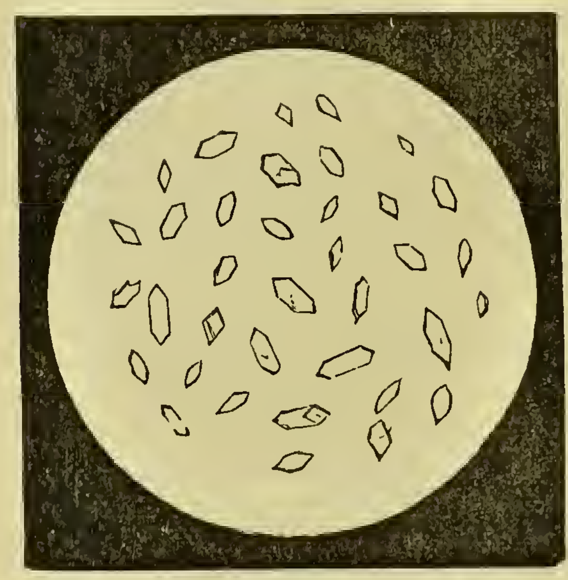
six grains, and half an ounce of the crystals is equivalent to three teaspoonfuls.

Tests.—1. *Nitrate of silver.* When added to a solution of oxalic acid, it produces an abundant white precipitate of oxalate of silver. A solution containing so small a quantity of oxalic acid as not to redden litmus-paper, is affected by this test; but when the quantity of poison is small, it would be always advisable to concentrate the liquid by evaporation before applying it. The oxalate of silver is identified by the following properties: It is completely dissolved by cold nitric acid. If collected on a filter, thoroughly dried, and heated on thin platinum-foil, it is dissipated in a white vapour with a slight detonation, and a residue of silver is left. When the oxalate is in small quantity, this detonation may be observed in detached particles on burning the filter previously well dried. 2. *Calcium sulphate.* A solution of oxalic acid is precipitated white by lime-water and all the salts of calcium. Lime-water is itself objectionable as a test, because it is precipitated white by several other acids. The salt of calcium, which, as a test, is open to the least objection, is the *sulphate.* As this is not a very soluble salt, its solution must be added in rather large quantity to the suspected acid poisonous liquid previously concentrated. A white precipitate of calcium oxalate is slowly formed. This precipitate should possess the following properties:—1. It ought to be immediately dissolved by nitric or hydrochloric acid. 2. It ought not to be dissolved by acetic, or any vegetable acid, or by ammonia.

In organic liquids.—The process is the same, whether it is applied to liquids in which the poison is administered, or to the *matters vomited*, or, lastly, to the *contents of the stomach.* Should the liquid be very acid, we must filter it to separate any insoluble matters; should it not be very acid, the whole may be boiled, if necessary, with distilled water filtered, and concentrated by evaporation. To the filtered liquid, acidulated with acetic acid, *acetate of lead* should be added until there is no further precipitation; and the white precipitate formed, collected and washed. If any oxalic acid was present in the liquid, it will exist in this precipitate under the form of oxalate of lead. Diffuse the precipitate in water, and pass into the liquid, for about half an hour, a current of sulphuretted hydrogen gas, taking care that the gas comes in contact with every portion of the precipitate. Black sulphide of lead will be thrown down, and with it commonly the greater part of the organic matter mixed with the oxalate of lead. Filter, to separate the sulphide of lead; the filtered liquid may be clear and highly acid. Concentrate by evaporation; the sulphuretted hydrogen dissolved in the liquid is thereby expelled, and oxalic acid may be ultimately obtained crystallized by slow evaporation in a watch-glass, or on a glass slide for microscopical observation. If crystals are obtained, they must be dissolved in water and tested in the manner above directed. As oxalic acid is very soluble in alcohol, this liquid may be occasionally employed for separating it from the contents of the stomach and from many organic compounds. Crystals may be obtained from the alcoholic solution, and these may be purified and tested by the methods already described. Owing to the effect of early vomiting and treatment, it is not usual to find much oxalic acid in the contents of the stomach. From milk, gruel, coffee, blood, mucus, and other viscid liquids, oxalic acid is readily separated by the process of *dialysis*, as described under sulphuric acid (see p. 74, *ante*). The liquid should be first boiled—the coats of the stomach (cut up) being included, if necessary. The distilled water placed on the outside of the tube will receive the acid. This may be concentrated by evaporation. Prismatic crystals may thus be procured, and the silver and calcium sulphate tests may be applied.

The presence of oxalic acid in an organic liquid may be detected by another dialytic method. Place a portion of the liquid containing the poison in a beaker, and insert in this a tube secured with skin or parchment-paper containing a solution of calcium sulphate. The oxalic acid will penetrate the membrane, and will form inside the mouth of the latter a deposit of crystals of oxalate of calcium, known by their octahedral form (Fig. 3).

Fig. 3.



Crystals of Calcium Oxalate obtained by dialysis of Coffee containing Oxalic Acid, magnified 350 diameters.

Sometimes the chemical evidence may depend on *stains* on articles of *clothing*. Oxalic acid discharges the colour of some dyes, and slowly reddens others; but unless the stuff has been washed, the acid remains in the fabric, and may there be detected. It does not corrode or destroy the stuff like mineral acids. In *Reg.* v. *Morris* (C. C. C., Dec. 1866) it was proved that the prisoner had attempted to administer a liquid poison forcibly to her daughter, a girl aged six years. It was sour in taste, made her lips smart, and caused vomiting. There was dryness of the lips, and inflammation of the lining membrane of the mouth. No portion of the substance administered could be procured, but a crystalline deposit of oxalic acid was obtained from some stains on the dress of the child. The woman was convicted.

Acid Potassium Oxalate, or Salt of Sorrel.—*Symptoms and Effects.*—This poisonous salt is much used for the purpose of bleaching straw and removing ink-stains, and is sold for this purpose under the name of essential salts of lemons. Its poisonous properties are not generally known, or no doubt it would be frequently substituted for oxalic acid. Out of four cases of poisoning by this substance, three proved fatal, while in the other the patient recovered. In the case of recovery, a young lady, aged twenty, swallowed an ounce of the salt dissolved in warm water. She was not seen by any one for an hour and a half; she was then found on the floor, faint and exhausted, having previously vomited considerably. There was great depression, the skin cold and clammy, the pulse feeble, and there was a scalding sensation in the throat and stomach. There was also continued shivering. Proper medical treatment was adopted, and she recovered in two days, still suffering from debility and great irritation of the stomach. During the state of depression, it was remarked that the membranes of the eyes were much injected and the pupils dilated. There was also great dimness of vision. (' Med. Gaz.,' vol. 27, p. 480.)

This salt destroys life almost as rapidly as oxalic acid itself; and in the symptoms which it produces, it closely resembles that poison. In one case, half an ounce killed an adult in so short a time as *eight minutes;* but probably the fatal effects were in this instance accelerated by the debilitated state of the person who took it. In another case death took place in ten minutes. (' Ann. d'Hyg.,' 1850, vol. 1, p. 162.) In some instances this poisonous substance has been supplied by mistake for cream of tartar, and has thus caused death.

Chemical Analysis.—It is not very soluble in cold water, but its solution may be readily mistaken for that of oxalic acid. The tests for oxalic acid may be applied for the detection of it in this salt. When a portion is heated, potassium carbonate is left.

VEGETABLE ACIDS.

The vegetable acids, such as the acetic, tartaric, and citric, are capable of acting as poisons. The editor has met with alarming laryngeal symptoms, besides the local corrosive action, produced by the swallowing of acetic acid. Bayard and Devergie have recorded a fatal case of poisoning with tartaric acid. (' Ann. d'Hyg.,' xlvi. p. 433.) In 1877 a woman, æt. 58, died in Sheffield from taking a quantity of aromatic vinegar.

CHAPTER 9.

ALKALIES AND ALKALINE SALTS.—POTASH, SODA, AND AMMONIA.—NITRATE AND SULPHATE OF POTASSIUM.—SALTS OF BARIUM.

POTASH AND SODA.

Symptoms.—The symptoms produced by potash and soda, when taken in large doses, are similar, so that one description will serve for both. The most common form in which these poisons are met with is in the state of pearlash (potassium carbonate) and soap-lees (sodium carbonate). The person experiences, during the act of swallowing, an acrid caustic taste, owing to the alkaline liquid, if sufficiently concentrated, excoriating the mucous membrane. There is a persistent sensation of burning heat in the throat, extending downwards to the stomach. Vomiting is not always observed; but when it does occur, the vomited matters are sometimes mixed with blood of a dark brown colour, and with detached portions or flakes of mucous membrane—this effect depending on the degree of causticity in the liquid swallowed. The surface is cold and clammy, and there is purging with severe pain in the abdomen, resembling colic. The pulse is quick and feeble. In the course of a short time, the lips, tongue, and throat become swollen, soft, and red. Other symptoms of a more serious kind sometimes show themselves. In 1877, a cook in a girls' boarding-school put four ounces of washing soda (crude carbonate) into the tea supplied to the pupils. They suffered from severe colicky pains and purging, continuing for several days, with griping pains, loss of appetite, and general feeling of weakness. One girl, æt. 16, who had partaken freely of the tea, in addition to these symptoms, suffered severely on the fifth day from purpura. There was hæmatemesis, with profuse bleeding from every mucous surface, and spots of ecchymosis on all parts of the skin. She had a tedious and very difficult recovery. It was calculated that she had taken about two drachms of soda. The most rapidly fatal case of alkaline poisoning reported is that of a boy, who died in *three hours* after swallowing three ounces of a strong solution of carbonate of potassium.

Appearances after Death.—In recent cases there are marks of the local action of the poison on the mucous membrane of the mouth, throat, and gullet. This membrane has been found softened, detached, and inflamed in patches of a deep chocolate colour, sometimes almost black. A similar appearance has been met with in the mucous membrane of the larynx and windpipe. The stomach has had its mucous surface destroyed in patches, and there has been partial inflammation. In one instance, as the result of the action of soda, it was puckered, hardened, and blackened. The *quantity* of these alkaline poisons required to destroy life is unknown. The fatal effects depend rather on the degree of concentration of the liquid than on the absolute quantity of alkali present.

Chemical Analysis.—When potash or soda, or the carbonate of either alkali, is contained in a poisonous proportion in any organic liquid, it will be observed that the liquid has not only a strong alkaline reaction, but it is soapy to the feel, frothy when shaken, and has a peculiar odour. The alkali may be obtained in the state of carbonate or otherwise by simply evaporating the suspected liquid and incinerating the residue in a silver or porcelain vessel. The presence of potash or soda may be easily determined by the appropriate tests for these alkalies. Potash gives a violet, and soda an intensely yellow colour to a colourless gas-flame.

AMMONIA.

The *vapour* of strong ammonia is poisonous. Several severe cases have been seen by the editor. It may destroy life by producing violent inflammation of the larynx, or of the lungs and air-passages. It is often employed injudiciously to rouse persons from a fit. A case is on record of an epileptic having died under all the symptoms of croup, two days after the application of strong ammonia in vapour to the nostrils, in order to rouse him from a fit.

Symptoms and Appearances.—The strong *solution* of ammonia produces, when swallowed, symptoms similar to those described in speaking of potash; but, as it is much more irritating, it produces a choking sensation, followed by intense heat and burning pain in the throat, gullet, and stomach.

Serious injury to the organs of respiration is one of the results of the action of this poison. A man liable to attacks of fainting, died in three days after swallowing a quantity of a liquid administered to him by his son. This liquid, which was at the time believed to be sal volatile, was, in fact, a strong solution of ammonia. The deceased complained immediately of a sensation of choking and strangling in the act of vomiting. Symptoms of difficulty of breathing set in, with other signs of irritation in the throat and stomach. The mucous membrane of the mouth and throat was corroded and dissolved; and it was evident that the liquid had caused great local irritation. The difficulty of breathing was such as to threaten suffocation, and at one time it was thought that an operation must be resorted to. The state of the patient, however, precluded its performance, and he died on the third day. On *inspection*, the viscera presented strong marks of corrosion. The covering of the tongue was softened, and had peeled off; the lining membrane of the air-passages was softened and covered with layers of false membrane, the result of inflammation; and the larger bronchial tubes were completely obstructed by casts or cylinders of this membrane. The lining membrane of the gullet was softened, and at the lower part, near its junction with the stomach, the tube was completely dissolved and destroyed. There was an aperture in the stomach in its anterior wall, about an inch and a half in diameter: the edges were soft, ragged, and blackened, presenting an appearance of solution. The contents of the stomach had escaped. On the inside, the vessels were injected with dark-coloured blood, and there were numerous small effusions of blood in various parts of the mucous membrane. The coats were thinned and softened at the seat of the aperture. The blackened and congested appearance of the lining membrane somewhat resembled that which is seen in poisoning with sulphuric or oxalic acid. The mucous matter on the coats of the stomach was feebly *acid*. No poison of any kind was found in the layer of mucus or in the coats. There was not in any part the slightest trace of ammonia, the poison which had caused the mischief. The deceased had lived three days; remedies had been used, and every trace of ammonia had disappeared. The immediate cause of death was an obstruction of the air-tubes, as a result of inflammation, caused by the local irritant action of the liquid: it was quite obvious that a quantity had entered the windpipe. The perforation of the stomach had probably taken place shortly before death, or was, perhaps, *post-mortem*, as there were no marks of peritonitis. The injury to the stomach and gullet would have been sufficient to cause death, even supposing that the liquid had not penetrated into the lungs. A child, about two years old, swallowed a teaspoonful of strong solution of ammonia. It fell to the floor breathing hurriedly, and became blue in the face. An hour afterwards, there were white patches on the tongue and cheeks, with congestion of the tonsils and pharynx. There was frequent vomiting, but no blood. Pulse, 164; temperature, 102·8° F. The child died the next day. It was unconscious, and there were convulsions at intervals. ('Med. Times and Gaz.,' 1878, i. p. 35.)

Solution of ammonia applied to the skin acts as a corrosive, and may inflame or cause the destruction of the parts which it touches. A man was convicted (*Reg.* v. *Gavan*, Stafford Sum. Ass., 1873) of throwing a liniment, containing a strong solution of ammonia, over the prosecutrix, with intent to injure her. The liquid was thrown in her face, and some portion reached the eyes; but she recovered from the effects. A weak solution acts as an irritant to the skin, while a strong solution causes vesication and a destruction of the part.

Carbonate of Ammonium.—The concentrated solution of this salt (sal volatile) is probably more active as a poison than is commonly supposed. A man, in a fit of passion, swallowed about five fluid drachms of a solution of sal volatile. In ten minutes he was seized with stupor and insensibility; but, upon the application of stimulant remedies, he recovered. He suffered for some time afterwards from severe irritation about the throat and gullet.

A female, æt. 19, while in a state of unconsciousness, was made to swallow a quantity of hartshorn. She immediately felt a severe pain in the stomach, and in about an hour afterwards she vomited some blood. This vomiting of blood continued for several days. These symptoms were followed by great irritability of the stomach, and the constant rejection of food. There was obstinate constipation of the bowels, with emaciation and loss of strength. She died in about three months from the time at which she had swallowed the alkaline poison. On inspection, the gullet was found healthy; but the orifice, at its junction with the stomach, was slightly contracted. The intestinal opening (pylorus) was contracted to the size of a crow-quill, and the coats were thickened. On the posterior wall of the stomach there was a dense cicatrix of the size of a half-crown, and from this point fibrous bands ramified in various directions. The duodenum and other parts of the intestinal canal were healthy. ('Med. Times and Gaz.,' 1853, ii. p. 554.)

Chemical Analysis.—Ammonia is distinguished from potash and soda by its pungent odour and entire volatility. The *Carbonate of Ammonium* may be known from other salts by its alkaline reaction, its odour, and its volatility as a solid; and from pure ammonia by its effervescing on the addition of an acid.

NITRATE OF POTASSIUM. NITRE. SALTPETRE.

Symptoms and Appearances.—This well-known salt has on several occasions destroyed life when taken in large doses. A man swallowed an ounce of nitre, mixed with water, by mistake for Epsom salts, about nine o'clock in the morning. It produced vomiting with severe pain, but no purging. There was coldness of the surface and lividity of the face. Death took place in three hours. On *inspection* the mucous membrane of the stomach was found highly inflamed, especially towards the middle of the greater curvature, where, for several inches, it resembled scarlet cloth. The pylorus and duodenum were of a deep crimson colour. The peritoneal surface was reddened, especially over the stomach, the vessels having a vermilion red colour, as if they had been injected. The heart and lungs were healthy, the blood was fluid, and more florid than natural. The other organs presented no unusual appearances. No analysis was made of the contents of the stomach, but that the nitre was the cause of death no doubt could be entertained, and a verdict was returned accordingly at the coroner's inquest. A man took an ounce of saltpetre in mistake for Epsom salts. Pain came on immediately, with profuse perspiration. He felt sick, but did not vomit till more than four hours had elapsed. When seen, between six and seven hours after taking the nitre, his pulse was 56 and full. The tongue was white, moist, and tremulous. Micturition was frequent for the first three hours. He recovered. ('Brit. Med. Jour.,' 1882, i. p. 304.) Two cases are recorded of recovery after the administration of two ounces of saltpetre. ('Brit. Med. Jour.,' 1877, ii. p. 520; 1882, i. p. 500.)

Analysis.—For the chemical properties and method of detecting this salt, see p. 78.

Potassium Chlorate. Chlorate of Potash.

Chlorate of potassium given in large doses acts as a poison, producing severe vomiting, profuse purging, intense difficulty of breathing, lividity of the countenance, and profound depression of the heart's action. After death, the blood is found of a chocolate colour, its pigment being destroyed. ('Das Chlorsaure Kali,' by Von Mering, p. 142.)

Potassium Sulphate. Sulphate of Potash.

Symptoms and Appearances.—The question whether this should be regarded as an irritant poisonous salt or not was much debated among members of the profession, in reference to a case which was tried in 1843 (*Reg.* v. *Haynes*, C. C. C.). The accused had given to the deceased, the night before her death, two ounces of potassium sulphate dissolved in water; and it was alleged that, a fortnight previously to this, she had taken in divided doses as much as a quarter of a pound of the salt. The woman thought that she was pregnant, but this was disproved by an examination of the body; and it was charged that the prisoner had given her the salt with the intention of causing a miscarriage. After the last dose, she was seized with sickness, and died within a very short time. The stomach was found empty, but highly inflamed; and there was blood effused on the brain. One medical witness referred death to the action of the sulphate as an irritant poison; another attributed it to apoplexy as an indirect result of the violent vomiting caused by it. The prisoner was acquitted of the charge of murder, but subsequently found guilty of administering the substance with intent to procure abortion. Both of the witnesses admitted that, in small doses, the salt was innocent; but that in the dose of two ounces it might produce dangerous effects. Several other fatal cases are recorded. ('Ann. d'Hyg.,' Avril, 1842.)

There is no doubt that the most simple purgative salts may, under certain circumstances, and when given in large doses, destroy life. A case is elsewhere related in which Epsom salts caused death, and gave rise to a criminal charge in this country. ('On Poisons,' 2nd edit. p. 4.) In May, 1875, a woman, æt. 27, died in a few hours from the effects of two ounces of Epsom salts taken at once. ('Pharm. Jour.,' June 12, 1875, p. 1001.) It is said that potassium sulphate has in some cases caused vomiting and other serious symptoms, from its containing as impurity zinc sulphate. This, if present, would be easily discovered by the appropriate tests for zinc (see p. 142, *post*).

Potassium sulphate may be easily identified. It is in hard dry crystals, soluble in water, forming a neutral solution, in which potash and sulphuric acid may be discovered by the appropriate tests (see pp. 73, 88).

Salts of Barium.

Chloride of Barium.—Symptoms.—A woman, æt. 23, took, by mistake for Epsom salts, less than a teaspoonful (100 grains) of the chloride. In half an hour there was a feeling of deadly sickness, with sharp burning pains in the stomach and bowels. Vomiting and purging set in violently, the purging being attended with straining. An hour and a half after she had taken the poison, the following symptoms were observed. The face was pale and anxious, the eyes deeply sunk, the surface cold, the heart's action feeble, the pulse scarcely perceptible, the tongue natural and warm, loss of muscular power, sensation and intelligence unaffected, the pupils natural. Fluids taken were instantly rejected, together with a ropy mucus. There was pain in the stomach, ringing in the ears, twitching of the face, and twisting of the legs and arms. In eight hours and a half the symptoms had abated, but in about fourteen hours the purging had returned, and the symptoms were much worse. There was a loss of voluntary muscular power. The breathing was slow and laboured, and indicated effusion in the bronchial tubes, but the woman was sensible. In fifteen hours she was convulsed, and these convulsions continued in paroxysms for two hours, when she died, seventeen hours after taking the poison. During the fits she had several watery evacuations, and consciousness was lost. There was no *post-mortem* examination. ('Lancet,' 1859, 1, p. 211.)

Another instance of death from barium chloride is reported ('Pharm. Jour.,' Aug. 10, 1872, p. 117); but no account is given of the dose taken, or of the symptoms and appearances. Kennedy states that, in using this compound as a medicine, he has found that few persons are able to bear the eighth of a grain; that it is analogous to corrosive sublimate; and that an overdose will produce similar effects. He has used it for many years, and he finds the proper dose is from the twelfth to the sixteenth part of a grain; but he cites no instance of its acting as a poison in a dose of one or two grains. ('Lancet,' 1873, ii. p. 28.)

Chevallier met with a case in which *barium acetate* had been supplied in a medicine in place of sodium sulphovinate. It caused the death of the patient, and produced serious symptoms in the druggist. He had swallowed a portion of the medicine, in order to show that there had been no mistake in its preparation. ('Ann. d'Hyg.,' 1873, 1, p. 395.) Barium nitrate acts like the chloride. The chlorate, used in pyrotechny, has acted as a poison.

Barium carbonate is said to have destroyed life in two cases, in each of which only one drachm was taken; but the following case shows that this compound is not so poisonous as the chloride. A young woman swallowed half a teacupful of the powdered carbonate, mixed with water, at a time when she had been fasting twenty-four hours. There was no particular taste. In two hours she experienced dimness of sight, double vision, ringing in the ears, pain in the head, and throbbing in the temples, with a sensation of distension and weight at the pit of the stomach. There was also palpitation of the heart. After a time she complained of pain in the legs and knees, and cramps in the calves. She twice vomited a fluid like chalk and water. The skin was hot and dry, the pulse frequent, full, and hard. These symptoms gradually abated, and she recovered, although the pain in the head and stomach continued for a long time. ('Med. Gaz.,' 14, p. 448.) A woman took a mixture of the carbonate and sugar in repeated doses, but in unknown quantity. She died on the second day, having suffered from vomiting, purging, pain, and other symptoms of irritation. On inspection, the mucous membrane of the stomach and intestines was inflamed. The carbonate was found in the stomach. ('Brit. Med. Jour.,' 1877, i. p. 888.) This salt is used as a poison for rats and mice.

Analysis.—Chloride of barium crystallizes in plates, and it is soluble in water. 1. The solution yields an insoluble white precipitate with sulphuric acid or an alkaline sulphate. This precipitate is insoluble in nitric acid. 2. The powdered salt, burnt on platinum wire in a smokeless flame, imparts to it a greenish-yellow colour. 3. Chlorine may be detected in it by a solution of nitrate of silver. Barium nitrate reacts like the chloride with sulphuric acid, and imparts a similar green colour to a flame. It also yields the reactions of a nitrate (see nitric acid, p. 78, *ante*).

Barium carbonate is a white insoluble powder. It is entirely dissolved with effervescence (carbonic acid) by diluted hydrochloric acid. On evaporation, it yields crystalline plates of the chloride of barium, which may be tested by the processes above mentioned.

CHAPTER 10.

PHOSPHORUS.—SYMPTOMS AND APPEARANCES.—CHRONIC POISONING.—CHEMICAL ANALYSIS.—RED PHOSPHORUS.

Poisoning with phosphorus is not uncommon in this country, as the result of accident and attempts at suicide; but homicidal poisoning by it is rare. The ordinary yellow, or soluble phosphorus is alone poisonous; the red, amorphous, or insoluble, variety has been clearly proved not to be poisonous. It is usually given either in the form of vermin-killer or rat-paste—a mixture of yellow phosphorus, fat, flour, and sugar—or as tips of lucifer matches infused in some liquid. The smell of yellow phosphorus, its taste, the fumes which it gives off, and its luminosity in the dark, commonly reveal its presence. At the Norwich Aut. Ass. 1871 (*Reg.* v. *Fisher*), a girl of 18 was convicted of an attempt to poison a family. She put a vermin-compound containing phosphorus into a teapot with the tea. When hot water was poured on it, the smell produced at once led to suspicion. Phosphorus was found in the tea, taken from a pot carelessly left about the house. The girl was convicted, and sentenced to penal servitude for life. Casper described a case in which the luminous appearance of the poisoned food led to a suspicion of poisoning with phosphorus, and this was subsequently proved. A woman put a preparation of phosphorus into some soup, and gave it to her husband. He ate it in a dark room in the presence of some friends, and they noticed that the liquid, as he stirred it, was luminous. ('Vierteljahrsschr. f. Gerichtl. Med.,' July, 1864.) In this way a person may be warned and a life saved. (See 'Ann. d'Hyg.,' 1870, 2, p. 203.)

Symptoms.—Phosphorus acts as an irritant poison; also specifically. The symptoms of irritation may manifest themselves in a few minutes after the ingestion of the poison. In general, however, there is a longer interval of some hours. In the first instance, the patient experiences a disagreeable taste, resembling that of garlic, which is peculiar to this poison. An alliaceous or garlic-like odour may be perceived in the breath. There is pain and oppression in the region of the stomach, malaise, eructation of phosphoric vapours having a garlicky odour; and these may be luminous in the dark. Vomiting is sometimes frequent and violent; in other cases quiet and at longer intervals. The abdomen is distended. Purging is not common. The vomited matters are coffee-coloured, or yellow and bilious, and may be luminous. There is intense thirst. The symptoms may increase in severity, ending in death from collapse in the course of a few hours—four to eight in the worst cases.

Nevertheless, in the majority of cases the progress to a fatal termination, though no less sure, is slower and more insidious. The irritant symptoms in a great measure subside; and, though the pulse is feeble and there is a certain amount of malaise, the patient may, to a casual observer, appear to be in almost a normal state of health. But after the lapse of three or four days, jaundice sets in and rapidly increases; there is great prostration of strength; the abdomen becomes distended; the liver is observed to be greatly enlarged, and vomiting of altered blood may come on, with intense thirst; the skin is cold; the pulse feeble, rapid, and perhaps imperceptible at the wrist; the urine is scanty and high-coloured, and contains casts from the kidneys. The fæces, previously suppressed, are now more abundant and contain blood. Coma sets in, with jactitation of the limbs, or muscular twitchings; and the patient succumbs generally about the fifth day after the administration of the poison.

A female, æt. 20, took several doses of phosphorus-paste; the first on the evening of Jan. 11th, 1877. The dose was repeated twice on the 12th. The quantity of paste taken was of the size of a large cob-nut, containing about two grains of phosphorus. On the morning of the 13th she retched, and at midday her appetite failed at dinner, and in the evening she vomited. At 10 p.m. on the 14th she was first seen by Tyson, about seventy-two hours after the first, and forty-eight hours after the last, dose was taken. She had then an excited aspect, and her breath had a phosphoric odour. There was tenderness over the region of the stomach. On the 15th there was faint yellowness of the conjunctivæ of the eyes, slight pain over the stomach, and nausea, but no vomiting. The urine was high-coloured and turbid. On the 16th there was decided jaundice, great thirst, and prostration. There was still a slight garlicky odour of the breath; but the urine and fæces showed no luminosity. There was no obvious enlargement of either the liver or the spleen. On the 17th the liver was enlarged; only a very little dark-coloured urine was passed; and there was much epigastric pain and tenderness. In the evening there was slight delirium. From this time she gradually sank, and died on the 18th, nearly a week after the administration of the first dose of the poison. On post-mortem examination, the liver was found to be of the usual size, but it had undergone extensive fatty degeneration, as had the heart also. There were no marked appearances in the stomach, which was almost filled with a blackish syrupy liquid. ('Guy's Hosp. Rep.,' 1877, xxii. p. 452.)

In 1876 a woman, and her daughter æt. 5, each drank some phosphorus-paste in warm water. The woman was seen four days later, apparently in her usual health. Subsequently she sickened, became jaundiced, and died, a week after the poison was swallowed. The child exhibited no symptoms till 7 a.m. on the day after taking the poison. She then vomited some slimy material, and her breath had a garlicky odour. In a few hours she was in a state of semi-collapse. Next day she became drowsy, then thirsty, restless, and vomited constantly. There was no jaundice. She died fifty-nine hours after the administration of the poison. On post-mortem examination, the heart was found to have undergone fatty degeneration, and it and the aorta exhibited ecchymosed patches. The stomach was considerably injected, and its surface was thickly coated with tenacious mucus. The small intestine was much conjested at its commencement, and to a less degree lower down. The liver weighed twenty-six ounces, was yellow, anæmic, and showed extreme fatty degeneration, except in isolated patches. In neither of these cases could the dose of phosphorus be ascertained. ('Guy's Hosp. Rep.,' 1877, xxii. p. 449.)

Chronic Poisoning. Phosophorus-vapour.—Chronic poisoning by phosphorus is accompanied by nauseous eructations, frequent vomiting, a sense of heat in the stomach, purging, straining, pains in the joints, wasting, hectic fever, and disease of the stomach, under which the patient slowly sinks. Some interest is attached to the chronic form of poisoning with phosphorus from the researches of Strohl and others on the effects of the *vapour* upon persons engaged in the manufacture of phosphorus or lucifer matches. It has been remarked that such persons have suffered from necrosis of the jaw, carious teeth, and abscesses. There has been also great irritation of the respiratory organs, and bronchitis has frequently shown itself among them. (See 'On Poisons,' 2nd edit. p. 345.) Cases of chronic phosphorus-poisoning are now of great rarity, owing to the precautions adopted among workers in phosphorus to prevent the introduction of the poison into the system.

Appearances.—Among the appearances produced by phosphorus are marks of irritation and inflammation in the stomach and intestines. The stomach has been found much contracted, and its mucous membrane inflamed, occasionally softened, and presenting purple or violet-coloured spots. In one fatal case the body was found in a state of great muscular rigidity. The membranes of the brain were congested, and there was serous effusion between them. The substance of the brain was also congested. The heart was flaccid and nearly empty. The mucous membrane of the stomach, gullet, and small intestines was very red, and there were patches in which the membrane was destroyed. When the stomach was opened, a white vapour escaped, accompanied by a strong smell of phosphorus. This organ contained a table-spoonful of a viscid greenish matter, from which particles of phosphorus with some Prussian blue (used as a colouring for the phosphorus-paste) subsided on standing. ('Lancet,' 1857, i. p. 600.) The mucous membrane has been found raised in small bladders or vesications, but this appearance was probably owing to putrefaction, as the body was not examined until twenty-three days after death. Schuchardt describes the blood as dark and fluid, and it does not become red on exposure to the air. Ecchymoses are sometimes found on the skin, on the surfaces of various organs, and on the lining membrane of the aorta. ('Brit. and For. Med. Rev.,' 1857, vol. 19, p. 506.; 'Jour. de Chim. Méd.,' 1857, p. 84.) The most remarkable appearance met with in the acute form of poisoning is a fatty degeneration of the voluntary muscles as well as of the liver, heart, and kidneys.

In the case of a girl, æt. 13, who died on the sixth day after taking phosphorus-paste beaten up with egg, there were the usual symptoms, with severe paroxysms of vomiting and pain. The matters first vomited were observed to be luminous in the dark. There were numerous ecchymosed patches in the cellular tissue of the skin of the abdomen over the rectus muscle; these were also seen on the chest and on the diaphragm. The stomach contained a dark-coloured thick fluid, like altered blood; the coats were not inflamed; and the surface of the inner coat was covered with a brownish-coloured mucus which had no odour of phosphorus. At the greater curvature the surface was dotted over with numerous small dark particles, consisting of coagula of altered blood adhering to the membrane, but easily removed from it. They had the appearance of effused coagula of blood, in petechial spots. The contents of the stomach owed its colour to these little masses of blood being disseminated through them. The duodenum contained a similar liquid. The intestines presented no abnormal appearance. The liver was in an advanced state of fatty degeneration. This condition of the liver has occurred so frequently in cases of phosphorus-poisoning that it may now be regarded as one of the characteristic appearances. ('Guy's Hosp. Rep.,' 1868, p. 242.)

In an interesting case recorded by Habershon ('Med. Chir. Trans.,' 1867, vol. 50, p. 87), in which a woman died on the fifth day, the symptoms and appearances were similar to those above described. The phosphorus was taken in the form of paste, and it is supposed in a dose of from three to four grains. There was much ecchymosis in patches in and about the cellular tissue of the abdomen and chest. There was fatty degeneration of the liver and kidneys. The stomach contained a large quantity of fluid like soot and water, and was covered with a tenacious bloody mucus. There was some congestion in the mucous membrane, and there was much redness with ecchymosis in the small intestines. The fatty degeneration induced by phosphorus is usually most marked in the liver, though it may extend to the kidneys, the heart, the glands of the stomach, to the muscular tissue generally, and to the arterioles and capillaries. The editor has seen decided enlargement of the liver produced within forty-eight hours of the time at which the poison was administered. The liver is usually enlarged, doughy, anæmic, and of uniform yellow or yellowish-white colour. The acini are distinct. Wagner describes an interlobular hypertrophy of the connective tissue. The hepatic cells are loaded with fat. The heart and muscles generally may be soft, yellow, and of defective tenacity. In place of transverse striæ, innumerable fat-globules and granules of fat are seen with the microscope. The glandular epithelial cells of the gastric follicles, and the cortex of the kidneys, may be filled with fat-globules.

Occasionally the liver is of a deep yellow tinge, alternating with reddish patches, simulating acute yellow atrophy of the organ. The viscera and the flesh of animals recently poisoned by phosphorus have the peculiar odour of this substance, and if the case is recent they are luminous in the dark. (Galtier, 'Toxicol.,' vol. 1, p. 184.) In the case of a woman who died while taking phosphorus medicinally, it was remarked that the whole of the organs were luminous; thus indicating the diffusion of this poison by absorption. (Casper's 'Wochenschr.,' 1846, pp. 115, 135.)

Fatal Dose.—That phosphorus is a powerful poison is proved by two cases quoted by Christison. In one, death was caused by a grain and a half in twelve days; in the other, by *two grains* in about eight days. The smallest *fatal dose* met with is in a case quoted by Galtier. A woman, æt. 52, took in divided doses, in four days, rather less than *one grain* of dissolved phosphorus. The largest dose taken at once, *i.e.* on the fourth day, is stated to have been half a grain. Symptoms of pain and irritation appeared, and the patient died in three days. The gullet, stomach, and small intestines were found much inflamed. ('Toxicol.,' vol. 1, p. 87.) When the phosphorus is dissolved in any liquid, or when it is finely divided, as in phosphorus-paste or in lucifer-matches, its action is then more powerful, as it is in a state well fitted for absorption.

In general several days elapse before a case proves fatal. Orfila met with one which terminated fatally in four hours, and Habershon quotes a case which is said to have proved fatal in *half an hour*. ('Med. Chir. Trans.,' 1867, vol. 50, p. 92.) This is the most rapid case on record.

Chemical Analysis.—Yellow phosphorus is a solid of waxy consistency, having a peculiar odour, and a taste resembling garlic. It is the odour and taste which prevent it from being criminally employed as a poison, and render it easy of detection in articles of food. It evolves a white vapour in daylight, and a faint bluish luminosity in the dark. It melts and takes fire at a temperature of 112° F., burning with a bright yellow flame, and producing white, opaque, acid vapours by combustion. It is not soluble in water, but it is dissolved by alcohol, ether, chloroform, and oils; and especially by disulphide of carbon.

The smell which phosphorus imparts to solids and liquids is characteristic. When it has been taken in a solid form the particles may sometimes be separated as a sediment, by washing the contents of the stomach in water. These may be melted under water into one mass, either by plunging the tube containing them into hot water, or by pouring hot water upon them in a glass. If a portion of the organic liquid is evaporated to dryness in the dark, the particles of phosphorus will be easily recognized by their luminosity, as well as by their combustion when the surface on which the material is spread is heated. Owing to its great solubility in carbon disulphide, phosphorus may be separated from many organic matters by digestion with this liquid. It is thus procured from flour and phosphorus-paste, or from the residue of the contents of the stomach after washing and decantation. On the spontaneous evaporation of the disulphide, decanted from the organic liquid or solid, the phosphorus may be procured in small globules or beads. These ignite when touched with a hot wire, and burn with the bright flame of phosphorus.

If the phosphorus is in a state of solution, or is in too small quantity to be dissolved out of the material by carbon disulphide, its presence may be indicated by distilling the liquid containing it in the dark.

The vapour appears luminous as it is condensed in a glass condensing-tube. So delicate is this process of distillation, which was first suggested by Mitscherlich, that in one experiment with the head of a single lucifer-match the luminosity appeared for half an hour in the condensing-tube. Absolute darkness is required for the success of this experiment. When taken in the form of matches, portions of sulphur, vermilion, or Prussian blue may be found in the sediment.

The substance known under the name of *red* or *amorphous phosphorus* is not possessed of poisonous properties. This fact, long since announced by Liebig, has been confirmed by experiment. It has been given to animals in doses of thirty grains without causing symptoms of poisoning. In 1860 a woman, æt. 26, swallowed the composition scraped from a number of lucifer-matches made with amorphous phosphorus. She suffered no inconvenience. She procured other matches of common phosphorus, took a decoction of them in coffee, and died from the effects.

Amorphous phosphorus is easily recognized by its red colour and infusibility. When a mixture containing it is heated to about 500° F., it burns like common phosphorus, and yields similar products. It is insoluble in all liquids, and by its insolubility in carbon disulphide it is distinguished and separated from common phosphorus. It has neither odour nor taste, and is not luminous in the dark.

METALLIC IRRITANTS.

CHAPTER 11.

ARSENIC.—ARSENIOUS ACID.—SYMPTOMS.—CHRONIC POISONING.—APPEARANCES AFTER DEATH.—FATAL DOSE.—CHEMICAL ANALYSIS.—ARSENITES.—ARSENIC ACID.—ORPIMENT AND OTHER COMPOUNDS.

White Arsenic. Arsenious Acid.—This substance, when freshly prepared by sublimation, exists in the form of *vitreous* or glassy arsenic in semi-transparent white masses, which gradually become opaque on exposure to air and light. More commonly it is met with in commerce as the *white arsenic* or *arsenic* of shops, in the form of a white powder, not unlike flour in appearance, but visibly crystalline when examined with a lens. It is almost tasteless, and hence may be readily introduced unperceived, and in large quantities, into most ordinary articles of food and drink. It is sparingly soluble in cold water, a wineglassful of which will dissolve about a fatal dose; but it is much more soluble in many other liquids. Arsenic, as it is sold to the public in small quantities, is required to be mixed either with 1-16th part of its weight of soot, which gives to it a greyish colour, or with 1-32nd part of its weight of indigo, and then it is blue. Sometimes, in place of indigo, ultramarine is improperly employed as a colouring. When ultramarine is used, the article is decolorized by all acid liquids, and by the gastric juice.

Symptoms.—The symptoms produced by this poison vary according to the form and dose in which it has been administered. The time at which they usually come on is generally in from half an hour to an hour after the poison has been swallowed. They may appear earlier or much later. In a case in which one drachm of white arsenic had been taken on an empty stomach, no symptoms appeared for two hours; in another, that occurred to Lachèse, in which a large dose was taken, there were no symptoms for seven hours. ('Ann. d'Hyg.,' 1837, vol. 1, p. 344. See also 'Med. Chir. Rev.,' 1854, p. 294.) And in a third their appearance was protracted for *ten* hours. The maximum period yet known is eighteen hours. (Seidel.) In all cases in which arsenic enters the system from without, as by its application to the skin, or to ulcerated or diseased surfaces, the symptoms are rarely manifested until after the lapse of some hours or even days.

The person first experiences a feeling of sinking or faintness, depression, nausea, followed by sickness, with an intense burning pain in the region of the stomach, increased by pressure. The pain in the abdomen becomes more and more severe; and there is violent vomiting of a brown turbid matter, mixed with mucus, and sometimes streaked with blood. These symptoms are followed by purging, which is more or less violent, and this is accompanied by severe cramps in the calves of the legs. The matters discharged from the stomach and bowels have had in some instances a yellowish colour, as it was supposed, from a partial conversion of the poison into sulphide, but more probably from an admixture of bile. The vomited matters are in some cases coloured with blood, and the mixture of blood with bile has often given to them a green, yellow, or brown colour. In other cases they may consist of a large quantity of mucus ejected in a flaky state and having a milky-white appearance, as if from admixture with the poison. The *colour* of the vomited matters may be blue or black when coloured arsenic has been taken; or the admixture of bile may render them of a deep-green colour. The vomiting is in general violent and incessant, and is excited by any liquid or solid taken into the stomach. There is tenesmus (straining), and the discharges by the bowels are frequently tinged with blood. There is a sense of constriction, with a feeling of burning heat in the throat, commonly accompanied by the most intense thirst. The pulse is small, very frequent, irregular, and sometimes wholly imperceptible. The skin is cold and clammy in the stage of collapse; at other times it is very hot. The respiration is painful from the tender state of the stomach. There is great restlessness, but before death, stupor sometimes supervenes, with paralysis, tetanic convulsions, or spasms in the muscles of the extremities. In one instance trismus (lock-jaw) appeared in three-quarters of an hour. (Orfila.) In another, severe and prolonged nervous symptoms, among the most prominent of which were epileptoid fits. (Marshall.) Although pain is in general among the early and well-marked symptoms, arsenic appears in some cases to destroy sensibility. In a case in which the stomach was found intensely inflamed after death, the patient complained of no pain during the time which she survived. In some cases purging is absent.

Chronic Poisoning.—Should the person recover from the first effects, and the case be protracted, or should the dose have been small and administered at intervals, there will be inflammation of the conjunctivæ, with suffusion of the eyes, and intolerance of light—conditions which are, however, often present among the early symptoms above described. There is also irritation of the skin, accompanied by a vesicular eruption, which has been called eczema arsenicale. Sometimes this has assumed the form of nettle-rash or of the eruption attending scarlet fever. Local paralysis, preceded by numbness or tingling in the fingers and toes, and other symptoms of nervous disorder, are also common consequences. Exfoliation of the cuticle and skin of the tongue, with the falling off of the hair, has likewise been witnessed. Salivation has been observed to follow, especially when small doses of the poison have been given for a length of time. ('Med. Gaz.,' vol. 16, p. 790.) Strangury and jaundice have been noticed among the secondary symptoms. (Marshall on Arsenic, pp. 44, 111.)

Arsenic is not an accumulative poison; it is temporarily deposited in the organs after absorption, but is rapidly eliminated by the urine; and in from two to three weeks, if the person survives, the whole of that which has been absorbed may be removed from the body. R. C. Maclagan states that he has found it passing out of the body by the urine as early as three-quarters of an hour after it had been taken. ('Ed. Med. Jour.,' 1864, II. p. 200.)

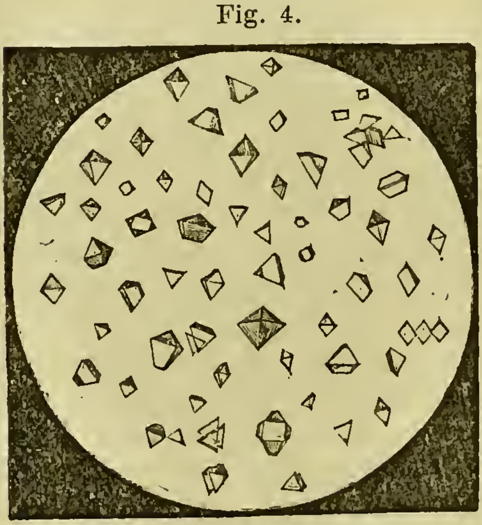
Appearances after Death.—The principal changes produced by arsenic are generally confined to the stomach and bowels. They are commonly well marked in proportion to the largeness of the dose, and the length of time that the person has survived after taking the poison. Attention must be first directed to the *stomach.* Arsenic seems to have a specific effect on this organ; for, by whatever channel the poison may have entered into the system, whether through a wounded, diseased, or ulcerated surface, or by the act of swallowing, or when introduced into the rectum or vagina, the stomach has been found inflamed. The mucous membrane of the stomach is sometimes partly detached, and is covered with a layer of mucus, mixed with blood or bile, and with a thick white pasty-looking substance containing arsenic. It is commonly found red and inflamed in dotted or striated patches, extending between the two apertures: the colour, which is of a dull or brownish red, becomes brighter on exposure to the air; at other times it is of a deep crimson hue, interspersed with black-looking lines or patches of altered blood. The redness is usually most strongly marked at the greater end of the stomach: in one case it may be found spread over the whole mucous surface, giving to it the appearance of red velvet; in another it will be chiefly seen on the prominences or folds of the membrane. In one instance the coats were thickened and of a gelatinous consistency, without any marked inflammatory redness. The stomach has been found highly inflamed in a case which proved fatal in *two hours.* Thus it would appear that intense inflammation of the mucous membrane may be observed within a very short period. This organ usually contains a mucous liquid of a dark colour tinged with blood. The coats are sometimes thickened in patches, being raised up into a sort of tumour, with arsenic embedded in them; at other times they have been found thinned. The mucous membrane is rarely found ulcerated, and still more rarely gangrenous. Ulceration of the membrane, as the result of the action of arsenic, has been found as early as ten hours after the poison had been taken. Perforation of the coats is not a common result of arsenical poisoning: there are but few instances on record. Various appearances are said to have been met with in the lungs, heart, brain, and urinary organs; but they are not so characteristic of arsenical poisoning as to admit of medico-legal use in enabling a medical man to distinguish poisoning from disease. It is to the stomach and intestines that he must look as the basis of reliable evidence in regard to appearances after death. Wilks has pointed out an ecchymosed condition of the lining membrane of the left ventricle of the heart in cases of acute poisoning by arsenic; and this condition may be associated with a general punctated ecchymosis of the pleura and peritoneum. The editor has seen the serous membranes generally presenting an appearance as if they had been sprinkled over with minute drops of blood; this condition being due to minute sub-serous extravasation of blood. In a few instances the mouth, throat, and gullet have been found inflamed; but in general there are no changes in these parts to attract particular attention. The mucous membrane of the *small intestines* may be inflamed throughout; but commonly the inflammatory redness is confined to the upper part, *i.e.* the duodenum, especially to that portion of it which joins the stomach. Of the large intestines, the rectum appears to be the most prone to inflammation. The liver, spleen, and kidneys present no appearances which can be connected with the action of arsenic, although these, like the other soft organs, may become receptacles of the absorbed poison. It is worthy of observation, in relation to the known antiseptic properties of arsenic, that the parts especially affected by this poison (the stomach and intestines) occasionally retain the well-marked characters of irritant poisoning for a long time after death. Absorbed arsenic does not, however, appear to prevent the decomposition of the soft organs in which it is deposited. That putrefaction is frequently retarded or arrested in the bodies of those poisoned by arsenic is generally admitted, and this may result in mummification. Schauenstein, however, does not consider that retardation of putrefaction is proved, and still less mummification. We entertain no doubt as to the retardation, and mummification appears also to be a well-established fact. (See Kornfeld in Friedreich's 'Blätter für Gerichtl. Med.,' 1885, p. 149.) A peculiar yellow pigment is often observed in the intestines of bodies exhumed after arsenical poisoning. This has usually been ascribed to the formation of yellow sulphide of arsenic (orpiment). It may be due to this pigment, but Campbell Brown is of opinion that it is due to a peculiar alteration of the pigments of the bile. ('Lancet,' 1884, i. p. 421; 'Brit. Med. Jour.,' 1884, i. p. 600.)

Action of Arsenic through the Skin.—Arsenic may destroy life as the result of external application to the skin, to any diseased or ulcerated surface, or to a wound. ('Guy's Hosp. Rep.,' 1864, p. 220.) Some importance is attached to this form of arsenical poisoning from the fact that the lives of many infants were, in 1878, destroyed by the use of a powder sold under the name of *violet powder.* Instead of employing pure starch in the manufacture of this powder, some makers have recommended as a substitute terra alba, or powdered gypsum. As in the Bradford lozenge case ('On Poisons,' 3rd edit. p. 354), arsenic has been substituted for terra alba, and has caused the deaths of many infants by external application. In twenty-eight cases in which this powder had been used to infants, there were twelve or thirteen deaths. ('Brit. Med. Jour.,' 1878, i. p. 795.) It set up inflammation and irritation in the skin, and was then absorbed. In one case the child was washed and then dusted over with this poisoned powder: this was also applied to its genital organs. On the second day after birth the powder was applied four times. There was at this time an unnatural redness of the skin. On the third day the skin was intensely red, and appeared unhealthy about the navel and vagina. The powder was then withdrawn, but the eruption became worse, and in some parts, the skin had a sloughy appearance. On the tenth day of the child's life, and on the sixth day from the last application of the powder, the child died from the effects of the absorbed poison. On a post-mortem examination there was nothing remarkable in the condition of the viscera. The body was buried, but exhumed twenty-one days after death for examination. Tidy found in the liver 1·5 grain of arsenic, in the stomach and intestines one grain, and in the kidneys traces. The powder used, which should have consisted of starch and magnesia, with orris root, contained 38·5 per cent. of white arsenic, with starch and magnesia. ('Lancet,' 1878, ii. p. 250.) For one of the deaths thus caused the vendor of the powder was tried on a charge of manslaughter (*Reg.* v. *King*, C. C. C., 1878), but acquitted; and it was thus decided that there was no criminal neglect or culpable ignorance in a drysalter not being able to distinguish arsenic from plaster of Paris. It was simply a case of *caveat emptor.* ('Pharm. Jour.,' Aug. 1878, p. 119.)

The smallest *fatal dose* of arsenic hitherto recorded is *two grains.* ('Prov. Med. Jour.,' 1848, p. 347; also 'Med. Gaz.,' vol. 39, p. 116.) Under circumstances favourable to the operation of this poison, the fatal dose in an adult may be assigned at from *two to three grains.* The editor has seen a case of arsenical poisoning in which repeated three-quarter grain doses of white arsenic, given with homicidal intent, were followed by general paralysis, beginning in the lower extremities, and gradually creeping upwards till the lower intercostal and other respiratory muscles were affected. Large doses of arsenic commonly destroy life in from eighteen hours to three days. The average time at which death takes place is twenty-four hours; but the poison may destroy life within a much shorter period. In one case death took place in two hours and a half. ('Guy's Hosp. Rep.,' 1850, 183. See also 'Ann d'Hyg.,' 1837, vol. 1, p. 339.) Foster met with the case of a child under three years of age, that from the effects of arsenic died within *two hours*. Finlay met with a case which proved fatal in one hour. ('Brit. Med. Jour.,' 1883, ii. p. 943.) One (a doubtful) case is said to have proved fatal in twenty minutes. On the other hand, life is occasionally protracted for many days. In 1847, a man who had swallowed 220 grains of arsenic was admitted into Guy's Hospital, and died on the *seventh* day. In the case of *Dr. Alexander*, death took place on the *sixteenth* day; and though a large quantity of arsenic had been taken, no traces were found in the body. ('Med. Times and Gaz.,' 1857, i. p. 389.) In an instance in which arsenic was applied externally to the head, the person did not die until the *twentieth day*.

Chemical Analysis.—Arsenic as a solid.—In the simple state, *white arsenic* may be identified by the following properties:—1. A small quantity of the powder, placed on platinum-foil, is entirely volatilized at a moderate heat (about 400° F.). If a small portion of the white powder is very slowly heated in a glass tube of narrow bore, it will be sublimed without melting, and form a ring of minute octahedral and tetrahedral crystals, remarkable for their lustre and brilliancy. Under a microscope the appearance of these crystals is highly characteristic (Fig. 4).

Fig. 4.



Crystals of Arsenious Acid by sublimation, magnified 30 diameters.

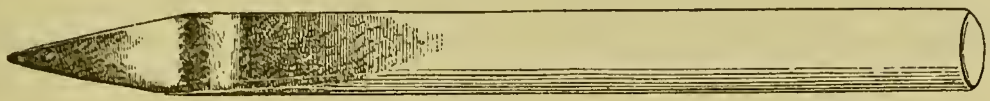
2. On boiling a small quantity of the powder in distilled water, it is not readily dissolved, but it partly floats in a sort of film, while a part becomes aggregated in small lumps at the bottom of the vessel. It requires long boiling, in order that it should become dissolved and equally diffused through water.

3. It is not perceptibly altered in colour when moistened with a *weak* solution of ammonium sulphide.

4. When a small portion of the white powder, *i.e.* from one-fourth to one-twentieth part of a grain, is heated with two parts of *soda-flux* (obtained by incinerating sodium acetate or tartrate in a closed vessel) in a glass tube about three inches long and from one-eighth to a quarter of an inch in diameter, it is decomposed: a ring of metallic arsenic of an iron-grey colour is sublimed and deposited in a cool part of the tube. In place of soda-flux a mixture of one part of potassium cyanide with three parts of dry (anhydrous) carbonate of sodium may be employed. During the reduction there is a perceptible odour, resembling that of garlic, which is possessed by metallic arsenic only while passing from a state of vapour to arsenious acid. In this experiment of *reduction*,

there are frequently two rings deposited in the tube—the upper and larger ring has a brown colour, and appears to be a mixture of finely divided metallic arsenic and arsenious oxide; the lower ring is small, and consist of the pure metal. The appearances presented by these sublimates is indicated in the annexed illustration (Fig. 5). By heating gently the tube containing the sublimate (reduced to powder) in another tube of larger diameter, the metallic arsenic, during volatilization, forms octahedral and tetrahedral crystals of arsenious acid, which, after examination by the microscope, may be dissolved in a few drops of water, and tested by one or two more of the liquid reagents.

Fig. 5.



Ordinary reduction-tube, with two sublimates: the upper, brownish black; the lower, the pure metal in an annular deposit.

The metallic sublimates, or the crystals produced from them, may be further subjected to the following process: Break the glass on which the sublimate is deposited, into fragments, and digest these in a few drops of the strong nitric acid, previously proved to be free from arsenic. The sublimate is thereby converted into arsenic acid. The acid solution should be evaporated to dryness; the white residue obtained should be dissolved in a few drops of distilled water, and a strong solution of nitrate, or of ammonio-nitrate, of silver added in small quantity to the residue. A brick-red coloration indicates arsenic acid, and thus proves incontestably that the sublimate was of an arsenical nature.

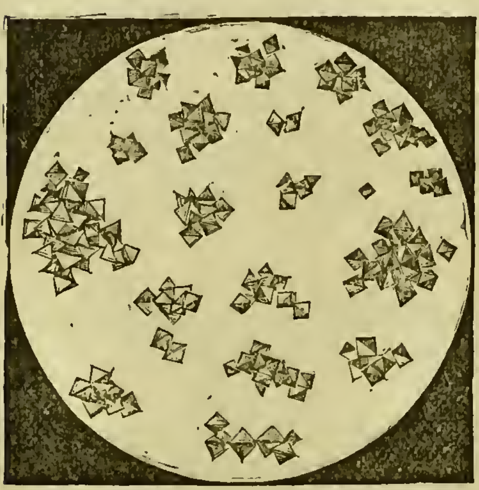
The upper or brownish-looking sublimate may be readily converted into one of the metal, by gently heating it in the flame of a spirit-lamp. Arsenious acid is then volatilized, and an iron-grey deposit of the less volatile metallic arsenic appears. If the heat is continued, the whole of the metallic sublimate is volatilized and deposited in a cool part of the tube, in transparent and colourless octahedra of arsenious acid. This is the special character of an arsenical sublimate; it may be thus distinguished from sublimates of all metals or metalloids. The lower metallic sublimate procured by reduction sometimes presents itself, not in an annular form, but in detached particles of an irregular spherical shape. These are of an iron-grey colour, quite unlike sublimed mercury, and, when examined with the microscope, it may be seen that they consist of crystalline nucleated masses, and that they are not accurately spherical. This sublimate is frequently produced in the last stage, when the residue in the tube is strongly heated. The process of reduction, with the corroborative results above mentioned, is, when thus applied, conclusive of the arsenical nature of the substance under examination.

5. A solution of stannous chloride is mixed with its volume of fuming hydrochloric acid and brought to the boiling point. If the

hydrochloric acid is pure, it should remain colourless, but if it contains a trace of arsenic, the liquid will acquire a light-brown colour. On adding a minute quantity of solid arsenious oxide to such a mixture, the oxide is dissolved and instantly decomposed, metallic arsenic being deposited in the form of a brown or brownish-black precipitate. A salt of antimony is not thus affected.

Arsenic in solution in Water. Liquid Tests.—The solution of arsenious acid is clear, colourless, possesses scarcely any perceptible taste, and has but a feeble acid reaction. In this state we should first evaporate slowly a few drops on a glass slide, when a crystalline deposit will be obtained. On examining this with a microscope, it will be found to consist of numerous minute octahedral crystals, presenting triangular surfaces by reflected light (see Fig. 6).

Fig. 6.



Crystals of Arsenious Acid from a solution, magnified 124 diameters.

1. *Silver Test.*—On adding to the solution of white arsenic *ammonio-nitrate of silver*, a pale yellow precipitate of arsenite of silver falls. The test is made by adding to a strong solution of nitrate of silver a weak solution of ammonia, and continuing to add the latter until the brown oxide of silver, at first thrown down, is almost redissolved. The yellow precipitate is soluble in nitric and acetic acids, as well as in ammonia.

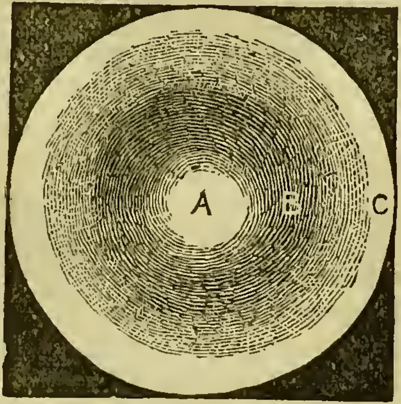
2. *Copper Test.*—On adding to another portion of the solution *ammonio-sulphate of copper*, a light-green precipitate (arsenite of copper) is formed, the tint of which varies according to the proportion of arsenic present, and the quantity of the test added; hence, if the arsenic is in small proportion, no green precipitate at first appears, and the liquid simply acquires a blue colour from the test. In less than an hour, if arsenic is present, a bright-green deposit is formed, which may be easily separated from the blue liquid by decantation. This test is made by adding ammonia to a weak solution of sulphate of copper, until the bluish-white precipitate at first produced is nearly redissolved. It should not be used in large quantity if concentrated, as the deep blue colour tends to obscure or conceal the green precipitate formed. The *dried* precipitate of arsenite of copper, when slowly and moderately heated in a well-dried reduction-tube, will yield a ring of octahedral crystals of arsenious oxide.

3. *Sulphuretted Hydrogen Test.*—The gas may be procured by adding to ferrous sulphide, in a proper apparatus, a mixture of one part of strong sulphuric acid and eight parts of water, and is washed by passing it through a little water. The arsenical liquid should be slightly acidulated with pure diluted hydrochloric acid, *before* the gas is passed into it. A yellow precipitate (orpiment) is produced if arsenic is

present; and it may be collected by subsidence. It is known to be sulphide of *arsenic* by the following properties:—1. It is insoluble in water, alcohol, and ether, as well as in diluted hydrochloric acid; but it is decomposed by strong nitric and nitro-hydrochloric acids. 2. It is immediately dissolved by potash, soda, or ammonia; forming, if no organic matter is present, a colourless solution: also by ammonium sulphide. 3. When dried and heated with three parts of soda-flux, or an equal part of dry potassium cyanide, it yields a sublimate of metallic arsenic.

4. *Marsh's Process. Nascent Hydrogen Test.*—The action of this test depends on the decomposition of arsenious acid and its soluble compounds by nascent hydrogen, evolved from the action of diluted sulphuric or hydrochloric acid on zinc. The materials should always be first proved to be free from arsenic. The apparatus is of the most simple kind, and is so well known as to need no description or illustration. The arsenic may be introduced into the short leg of the tube in the state of powder; but it is far better to dissolve it in water by boiling, either with or without the addition of a few drops of hydrochloric acid. The metallic arsenic combines with the hydrogen, forming arsenetted hydrogen gas, which possesses the following properties:—1. Filter-paper wetted with a solution of nitrate of silver is immediately blackened by the gas, and lead-paper is not changed in colour. 2. It burns with a pale bluish-white flame, and thick white smoke (arsenious acid) is evolved. 3. A slip of glass or of white porcelain held in the flame near the point (for not too long a time) acquires a dark stain from the deposit of metallic arsenic upon it. This deposit presents a metallic lustre in the centre (Fig. 7, A), a white film of arsenious acid on the outside (C), and between the two a dark ring of a pulverulent substance (B), which, when viewed by transmitted light, is hair-brown in colour towards the margin, but perfectly opaque in the centre. In order to determine the arsenical nature of the deposits, the following plan may be adopted: Several of them should be received and accumulated in small porcelain capsules, held in the flame of the burning gas. To one, add a solution of chloride of lime (bleaching powder): the arsenical deposit is immediately dissolved. To a second, add a solution of sulphide of ammonium: the metallic deposit is detached, but not perfectly dissolved; yet on evaporation it yields a pale yellow film of sulphide of arsenic. To a third, add a few drops of the strong nitric acid. The deposit is dissolved. Evaporate the acid solution gently to dryness, carefully neutralize the residue, and add one or two drops of a solution of nitrate of silver: a brick-red stain or a dark-red precipitate of arsenate of silver will be produced.

Fig. 7.



Deposit obtained by Marsh's Apparatus.
A, Metal. B, Mixed deposit. C, Arsenious Acid.

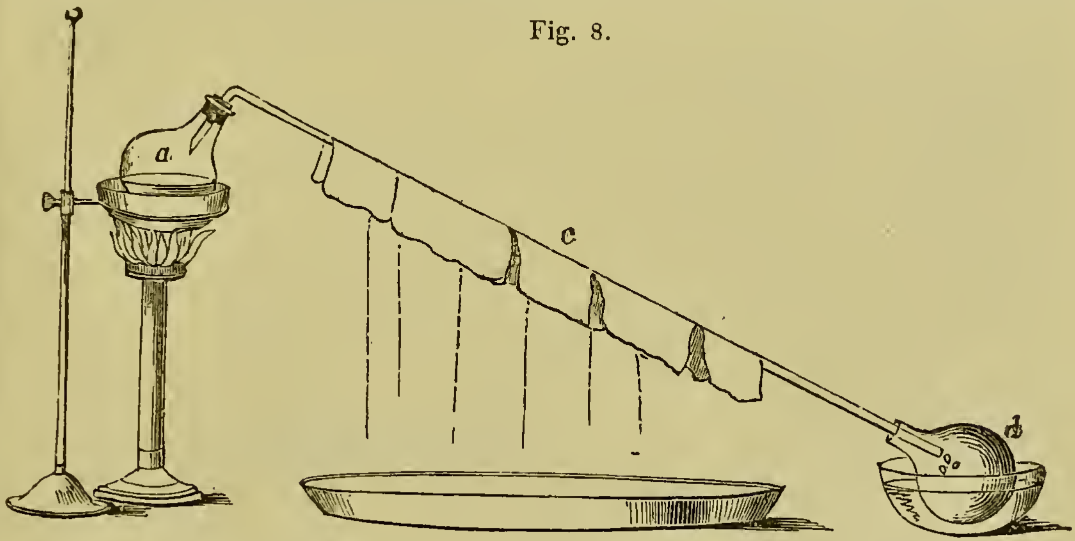
5. *Reinsch's Process.*—In the application of this process, the liquid suspected to contain arsenic, or the solid dissolved in distilled water, is boiled with from one-sixth to one-eighth its bulk of *pure* hydrochloric acid (proved to be free from arsenic), and a small slip of *pure* copper is then introduced. A slip of polished copper-foil (electrolytic copper) about a quarter of an inch square, attached to the end of a thin platinum wire, may be employed for the experiment. The copper must be first proved to be free from arsenic, as this is a very common contamination of all commercial copper in the form of foil, gauze, or wire. If arsenic is present in the liquid, even in small quantity, the polished copper acquires, either immediately or within a few minutes, a dark iron-grey coating from the deposit of this metal. This is apt to scale off if the arsenic is in large quantity, or if the liquid is very acid or long boiled. We remove the slip of copper, wash it in water, dry it, and gently heat it in a small reduction-tube, when arsenious oxide will be sublimed in minute octahedral or tetrahedral crystals; if these should not be apparent from one piece of copper, several may be successively introduced. When the quantity of arsenic is small, the polished copper merely acquires a faint bluish tint. The deposit is in all cases materially affected by the quantity of water present, or, in other words, the degree of dilution, and sometimes it will appear only after the liquid has been much concentrated by evaporation. The presence of arsenic as an impurity in copper may be detected by the following method suggested by Abel. Add to pure hydrochloric acid, diluted with six parts of water, one or two drops of a weak solution of ferric chloride. Boil the acid liquid and introduce the copper, well cleaned and polished, into the boiling liquid. Arsenical copper soon acquires a dark tarnish, while the non-arsenical (electrolytic) copper retains its red colour under these circumstances.

Arsenic in liquids containing organic matter.—Arsenic may exist in an insoluble form—*i.e.* as a crystalline powder—in the contents of the stomach or any liquid article of food. If coarsely powdered, it may be separated as a heavy sediment, by careful washing with distilled water, and then dried and tested by the reduction process (p. 104). Any liquid for analysis should be strained through muslin, or filtered through paper, in order to separate all insoluble matters: these should be well pressed and drained. Should the liquid be coloured, this is of little moment, provided it is clear. If viscid, it should be diluted with water, and boiled with a small quantity of hydrochloric acid; on standing, a deposit may take place, and this should be separated by a filter. As a trial-test, we may now boil in a portion of the liquid, acidulated with pure hydrochloric acid, a slip of pure polished copper, and examine any deposit on the metal by the method of Reinsch above described. If the copper comes out unchanged, there is no considerable quantity of arsenic present.

When arsenic is present in an organic liquid in large quantity, it may be precipitated as sulphide by a current of washed *sulphuretted hydrogen.* The liquid should be boiled, filtered, and acidulated with hydrochloric acid before passing the gas into it. When precipitation has ceased, the liquid should be again filtered, the precipitate collected, dried, and weighed. By operating on a measured portion of the solution, the amount of white arsenic present may be determined by the weight of the sulphide obtained—five parts by weight of sulphide being equal to four parts of white arsenic. The properties of the yellow precipitate should be verified according to the directions given at p. 107.

Distillation Process.—When the poison is in so small a quantity that it does not admit of precipitation by sulphuretted hydrogen, and no solid particles of arsenic are found in the stomach, in its contents, or in any article of food, another method may be resorted to for detecting its presence. This method equally applies to the detection of arsenic deposited as a result of absorption in the soft organs of the body, as in the liver, kidney, or heart, and to arsenic in all its forms, except the pure insoluble sulphide or orpiment. The substance, whether food, blood, mucus, the liver, or other organ, should be first thoroughly *dried*, either *in vacuo*, in a current of dry air, or by a water-bath. The dried solid should then be broken into small portions and placed in a flask or retort of sufficient capacity, with enough of the strongest hydrochloric acid (free from arsenic) to drench it completely. After some hours' digestion in the cold, the retort or flask (*a*, Fig. 8) containing the mixture —which should be of such a size that the materials should not fill it to more than one-third or one-half of its capacity—should be fitted with a long condensing-tube (*c*) (or a Liebig's condenser may be used), and then gradually heated by a sand-bath until the acid liquid begins to pass over. A metallic head, formed of a cone of tin-plate or sheet-copper, should be placed over the retort or flask so as to concentrate the heat and prevent condensation in the upper part of the vessel. A small flask receiver (*d*) with a loosely fitting cork may be employed to collect the product. This should contain a small quantity of distilled water, so as to fix and condense any acid vapours that may pass over. The receiver, as well as the condensing-tube, should be kept cool by wetting its surface with cold water diffused on a layer of blotting-paper

Fig. 8.



Apparatus for distilling organic and mineral substances containing arsenic.

placed over it. A perfect condensation of the distilled liquid is ensured by this arrangement. The distillation may be carried to dryness, or nearly so, on a sand-bath; and it is advisable, in order to ensure the separation of the whole of the arsenic as chloride, to add to the residue in the retort when cold, another portion of pure and concentrated hydrochloric acid, and again distil to dryness. By this process arsenic is at once separated from every metal excepting antimony, and these metals may be easily distinguished by tests applied to the distillate. If a little pianoforte wire be dissolved in dilute hydrochloric acid, and added to the solution in the flask, no antimony will pass into the distillate.

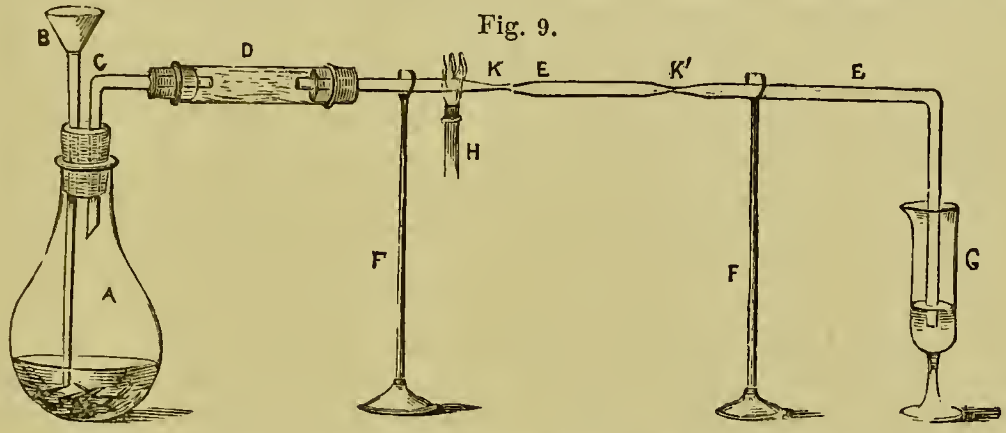
The liquid product may be coloured, turbid, and highly offensive if distilled from decomposed animal matter. Exposure to the air for a few hours sometimes removes the offensiveness, and there is a precipitation of sulphur, or of some sulphide of arsenic. The distillate may be separated from any deposit by filtration, and, if still turbid, it may be again distilled at a lower heat to separate it from any organic matter that may have come over. If there is a yellow deposit, it should be examined for sulphide of arsenic.

If arsenic is present in the substance submitted to distillation, the distillate will contain arsenic in the form of soluble chloride: this does not volatilize from a diluted solution at common temperatures. The quantity of dry organic substance used in the experiment must depend on the quantity of arsenic present, as revealed by a preliminary trial with Reinsch's process. If large, two or three drachms of the dried substance, or even less, will yield sufficient chloride of arsenic for further proceedings. For the absorbed and deposited poison, half an ounce of the dried organ, corresponding to two ounces of the soft organ, will frequently suffice; but a negative conclusion of the absence of arsenic should not be drawn from a smaller quantity than from two to four ounces of the dried substance, whether liver, kidney, or heart. These tissues, it must be remembered, contain about 76 per cent. of water. If oily matter should be distilled over, this may be separated by passing the distillate through a paper filter wetted with water.

The distilled liquid, containing *chloride of arsenic*, should be submitted to a further analysis. For this purpose one-third of it should be diluted with three or four parts of water, and boiled in a clean flask. When boiling, a piece of bright copper-foil (free from arsenic), of about the size of the 1-16th of a square inch, should be introduced. If there is chloride of arsenic in the liquid, even up to the 1-4000th of a grain, its presence will be indicated by a change of colour, and by the deposit of a dark metallic film on the copper. If the quantity of arsenic present is believed to be very small, the surface of copper introduced should be proportionately small. Another portion of the distilled liquid added to the stannous chloride and boiled (see p. 105) will give a brown colour or a brown precipitate, according to the quantity of arsenic present. If this is large, a dark mirror-like layer of metallic arsenic is deposited on the inside of the tube. The remaining two-thirds of the distilled liquid, sufficiently diluted, should now be introduced into a

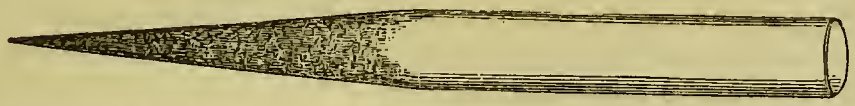
Marsh's apparatus, or into an evolution-flask provided with a funnel-tube, the capacity of which must be regulated by the quantity of acid liquid to be examined. The kind of apparatus employed in this stage is represented in the engraving (Fig. 9, below): A the flask, with funnel-tube B, and connecting-piece C; the funnel-tube should be long enough to dip just below the surface of the acid liquid. The short connecting piece is bent at a right angle, and, like B, is carried through a closely fitting cork in the neck of the flask. This tube should be only long enough to go through the cork, and its open end should be bevelled off so that any vapour which is condensed on it may drop back as a liquid into the flask. D is the drying-tube containing fragments of chloride of calcium, secured by cotton wool at both ends. At the flask end of this tube should be placed some well-dried bibulous paper, saturated with acetate of lead. This has the advantage of stopping any gaseous sulphur compound which may escape from the zinc or acid liquid. E E, a hard and not easily fusible glass tube, free from lead, contracted in two situations, K K′, to about the diameter of the tenth of an inch or less, the tube itself having a diameter of from a quarter to three-eighths of an inch. F F are supports made of stout wire, to prevent the tube from falling when heated to redness. G is a test-glass to hold one or two drachms of a strong solution of nitrate of silver. H is a Bunsen's burner, which gives a stronger heat than a spirit-lamp, although the latter may be used.

Fig. 9.



Apparatus for testing Chloride of Arsenic obtained by distillation.

Fig. 10.



Portion of tube separated with a deposit of Metallic Arsenic in the contracted portion.

The arrangement being thus made, the zinc and hydrochloric acid are first tested as to their freedom from arsenic. Portions of pure zinc are placed in the flask A, the parts of the apparatus are then connected, and pure hydrochloric acid, diluted with three or four parts of water, is poured into the flask by the funnel B, which operates as a safety-valve. Bubbles of air and gas speedily appear in the liquid in G, if the corks fit well and the whole of the arrangements are air-tight. Pure zinc is sometimes but imperfectly acted on by the acid. In this case some clean platinum wire or foil may be wound round the bars of the zinc, and the evolution of hydrogen will be thus accelerated. It is, however, better that the hydrogen should come off rather slowly. If the materials are pure, the solution of nitrate of silver should undergo no change of colour. The glass G should be placed on a sheet of white paper, whereby the slightest tinge of brown or black is made perceptible. When all the air is expelled from the tube, the smokeless flame H may be applied to it at about one inch in front of a contraction of the tube, as indicated in the engraving, and the glass heated to redness. No metallic deposit should take place at K. If the materials are quite pure, the transparency of the glass tube at K will be unchanged. From a quarter to half an hour will be sufficient for this experiment. Now add to the acid liquid in the flask A a portion of the liquid obtained by distillation. The presence of arsenic in this will be immediately revealed by the silver solution in the glass G acquiring a brown or black colour, according to the quantity of arsenic present, and at the same time deposits of metallic arsenic may be obtained by heating the glass tube E E.

The silver solution is allowed to become saturated with the gas. Any escape of the gas from the glass, or by leakage from any of the junctions of the apparatus, is at once indicated by holding near to the spot, filtering-paper wetted with nitrate of silver. This is instantly blackened. The glass with the silver solution is removed, the end of the tube well washed, or another tube substituted for E E, and this is allowed to dip into about one drachm of fuming nitric acid in a test-glass similar to G, or in a small porcelain capsule. After a time, the acid loses its colour, and the metallic arsenic of the gas is converted into arsenic acid, which may be obtained by evaporation.

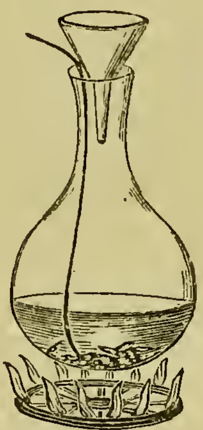
The further testing of the products is simple. 1. The silver solution contains arsenic in the state of dissolved arsenious acid, with some excess of nitrate of silver. By filtration it is obtained colourless and clear. A weak solution of ammonia is then added to it, and yellow arsenite of silver is precipitated (see p. 106). 2. The nitric acid liquid is evaporated to dryness in a small porcelain capsule. One or two drops of water are added to the residue, with a drop of weak ammonia if it should be very acid. A solution of nitrate of silver is then added to it; arsenate of silver, of its well-known brick-red colour, is immediately produced. 3. The portions of tube K K′ with the metallic deposits in them may be separated by a file, and then hermetically sealed; or, if necessary, one or more of them may be tested by the methods described in a preceding page.

With these results the evidence of the presence of arsenic may be considered to be conclusive. The poison is obtained by this process, not only in its pure metallic state, but in the distinct two forms—arsenious and arsenic acids. It will be observed that Reinsch's process is here employed as an adjunct to Marsh's process in an improved form, in which the burning of the gas is unnecessary.

The editor prefers to precipitate the liquid in the receiver, after dilution with water, by means of a stream of sulphuretted hydrogen gas, collect, wash, and dry the precipitate. It is then mixed with a dry flux of sodium carbonate and potassium cyanide, and introduced into a hard narrow glass tube, through which a stream of *dry* carbonic acid gas is passing. On applying heat to the mixture of yellow sulphide of arsenic and flux, a fine sublimate of metallic arsenic is obtained, with a minute trace of arsenic; and to this sublimate appropriate tests can be applied (see p. 107).

Reinsch's process can be employed for detecting arsenic, deposited as a result of absorption, in the liver, kidneys, or other soft parts. About four ounces of the organ, or more if necessary, cut into small pieces, may be boiled in a flask in a mixture of one part of pure hydrochloric acid and four of water, until the structure of the organ is broken up. The flask may be of the shape represented in the annexed engraving (Fig. 11), and either a naked flame or a sand-bath may be employed. A small glass funnel should be placed in the neck of the flask. This receives and condenses the acid vapour which falls back into the flask. By this arrangement the boiling may be continued for a long time, without material loss by evaporation. The flask should not be more than half full, and heated gently until all froth is expelled. A fine platinum wire, having a small piece of pure copper-foil, should be immersed in the liquid when boiling. This enables the operator to remove the copper and examine it at intervals, after immersing it in distilled water. If it is much coated with metallic deposit, larger portions of copper-foil may be successively introduced until the liquid is exhausted. The deposit on the copper may then be tested by the method described at p. 108.

Fig. 11.



Flask employed in the analysis of substances by Reinsch's process.

It is remarkable for what a length of time the copper retains the arsenic deposited upon it. Some copper-gauze on which arsenic had been thus deposited was examined after twenty-five years, and, although much changed in appearance by exposure, it yielded a perfect sublimate of octahedral crystals.

It need hardly be observed that the *quantity of arsenic found in the stomach* or other organs can convey no accurate idea of the quantity actually taken by the deceased, since more or less of the poison may have been removed by violent vomiting and purging as well as by absorption and elimination. A large quantity found in the stomach or bowels indicates a large dose; but the finding of a small quantity does not prove that the dose was small. The value of chemical evidence does not depend on the discovery of any particular quantity of poison in the *stomach*—it is merely necessary that the evidence of its presence in the body should be clear, distinct, conclusive, and satisfactory. At the same time, a reasonable objection may be taken to a dogmatic reliance upon the alleged discovery in a dead body of minute fractional portions of a grain; and, considering the great liability to fallacy from the accidental presence at that date of arsenic in the articles used for its detection, the chemical evidence in the French case of *Madame Laffarge* (1840), in which the whole quantity discovered in the dead body was stated to be the 1-130th part of a grain, was of a most unsatisfactory kind, and should have been rejected. No man with any respect for his character, or for the common sense of a jury, would base chemical evidence on the thousandth, or less than the thousandth, part of a grain of poison in a case of life and death.

The condition of the arsenic found in a stomach should be specially noticed. A witness should be prepared to say whether it is in fine powder or in coarse fragments; whether it is mixed with soot or indigo, or whether it is in the ordinary state of white arsenic. These points may be material as evidence in reference to proof of possession, of purchase, or administration. Arsenic is *not* a normal constituent of the human body. Under no circumstances is it found in the tissues after death, except in cases in which it has been taken or administered during life.

ARSENITE OF POTASSIUM. LIQUOR ARSENICALIS. (FOWLER'S SOLUTION.)—*Symptoms and Appearances.*—There is a case recorded in which this medicinal solution destroyed life. A woman took half an ounce (= two grains of white arsenic) in divided doses, during a period of five days, and died from the effects. There was no vomiting or purging, but after death the stomach and intestines were found inflamed. ('Prov. Jour.,' 1848, p. 347.) A mixture of arsenic, soft-soap, and tar-water is largely used in agricultural districts for killing the fly in sheep. This has caused death, under the usual symptoms of arsenical poisoning, in at least two instances. In 1874 the *Coombs* family, consisting of eight persons—the father, mother, and six children—were all poisoned by drinking water from a bucket which had contained an arsenical sheep-dipping composition. The mother and three of the children died. The symptoms produced were unusual—diarrhœa being a less prominent symptom than vomiting. The poison appeared to exercise a profound impression upon the nervous system, producing tetanic spasms and convulsions. An arsenical rash was a characteristic of the severest and fatal cases. In the bodies of the mother and one child the editor detected arsenic. The bodies of the other two children were not examined for poison.

Analysis.—The solution has the odour of tincture of lavender, is of a reddish colour, and has an alkaline reaction. One fluid ounce of it contains 4⅓ grains of arsenious oxide. It gives a green precipitate (arsenite of copper) with sulphate of copper, and a yellow precipitate with nitrate of silver. Acidulated with hydrochloric acid, and treated with a current of sulphuretted hydrogen gas, it yields a yellow sulphide; and, when boiled with that acid and pure copper, a deposit is obtained which readily furnishes, by heat, octahedral crystals of arsenious oxide.

Fly-Water is a name applied to solutions of various arsenical compounds in water. Mixtures of this kind are formed by dissolving one part of the arsenite of sodium or potassium and two parts of sugar in twenty parts of water. Paper soaked in this solution, and dried, is used for killing flies under the name of *Papier moure;* and perhaps this is the safest form in which arsenic can be used for such a purpose. The editor has found the fly-papers of commerce to contain from 7½ to 10 grains each of arsenious acid in a soluble form. In 1884 two women were convicted (*Reg.* v. *Flanndgan and Higgins*, Liverpool Winter Ass., 1884) of the murder of four persons by means of infusions of such papers. ('Brit. Med. Jour.,' 1884, i. pp. 419, 469.)

Arsenite of Copper. Scheele's Green. Emerald Green.—This is a metallic arsenite, met with in commerce and the arts; and it constitutes, wholly or in part, a great variety of green pigments employed for paper-hangings, known as emerald green (aceto-arsenite of copper), mineral green, Brunswick, Schweinfurt, Vienna, or Paris green. It is also found in the form of oil-paint, forming cakes in boxes of water-colours, spread over confectionery, in wafers, on adhesive envelopes, in wrappers for chocolate, isinglass, &c., and lastly, and most abundantly, in various kinds of green decorative papers used for covering the walls of sitting and bed rooms.

Although this compound is insoluble in water, it is sufficiently soluble in the acid mucous fluids of the stomach to be taken up by the absorbents, and carried as a poison into the blood. Roussin has traced the means by which this insoluble poison finds its way through the skin, and the circumstances under which it may be absorbed by the unbroken skin. In two cases which proved fatal in 1865, the workmen suffered chiefly from vomiting and colicky pains. The skin was tinged of a green colour, and arsenic was detected in the soft organs. He found that all poisons were liable to be absorbed by the unbroken skin, when, as a result of evaporation, a solid film was left on the surface. Alcohol and other solvents of fat, when used as solvents for the poisonous solid, would favour its absorption into the body. ('Ann. d'Hyg.,' 1867, pp. 179, 182.)

In a case which was the subject of a criminal trial, this substance was proved to have caused the death of a gentleman by reason of its having been employed to give a rich green colour to some blanc-mange served at a public dinner—the person who employed it considering that emerald or mineral green was nothing more than an extract of spinach. It led to death under the usual symptoms, and the parties were convicted of manslaughter. (*Reg.* v. *Franklin and Randall*, Northampton Sum. Ass., 1848.)

The *symptoms* of poisoning that have been observed in persons who have inhabited rooms of which the walls were covered with this arsenical compound, are as follows: Dryness and irritation of the throat with bronchial cough, irritation of the mucous membrane of the eyes and nostrils, languor, headache, loss of appetite, nausea, colicky pains, numbness, cramp, irritability of the bowels attended with mucous discharges, great prostration of strength, a feverish condition, and wasting of the body. These symptoms may not all present themselves in any one case; they are derived from the examination of numerous cases. No suspicion of the cause has in many instances been entertained until ordinary treatment had failed to impart relief, and an analysis of the paper had been made. The connection of the symptoms with this cause appears to have been in some instances clearly established by the fact that, after the removal of the paper, especially from bedrooms, the symptoms have disappeared. ('Brit. Med. Jour.,' 1876, ii. p. 653; also 1877, i. p. 8.) It is, however, proper to observe that comparatively few of those who are exposed suffer from symptoms of poisoning. Various deaths, chiefly among children, from the use of this paper are now recorded; and it is probable that to the noxious practice of covering the walls of our sitting and bedrooms with large quantities of arsenic in loose powder, many insidious cases of illness and chronic disease may be referred. Men and women employed in the manufacture of these poisonous pigments suffer severely. (See 'Ann. d'Hyg.,' 1847, 2, p. 56; 1859, 2, p. 107; and 1867, 2, p. 179.) Kittel states that girls employed in making artificial green leaves, in which this substance is used in fine powder, suffer from inflammation of the conjunctivæ, with thickening and swelling of the eyelids. ('Lancet,' 1873, i. p. 174.) The precautions now adopted render such cases rare. Children's toys are often coloured with this poisonous compound. In one case a child, æt. 5 years, was seized with sickness, diarrhœa, and great depression. The cause of these symptoms was traced to a box of counters coloured bright green. The child had imbibed the poison, either by handling or putting the counter into its mouth.

Analysis.—For the chemical characters of SCHEELE'S GREEN, see p. 106. The wall-paper pigment called EMERALD GREEN is a mixture of arsenite and acetate of copper. The green colour is very intense, even by candle-light. The presence of arsenic in this compound may be easily detected by the tests for solid arsenic (p. 104); but the following is a simple method which admits of speedy application: A slip of the suspected paper should be soaked in a moderately strong solution of ammonia. The green colour is removed, and a blue compound of copper is formed and dissolved in a few minutes. This result establishes only the presence of a compound of copper soluble in ammonia. If the ammonia does not become blue, there is no compound of copper present; if it does become blue, a large crystal of nitrate of silver should be placed in a white saucer, and a small portion of the blue liquid poured over it. The presence of arsenic in the blue liquid is revealed by the production of yellow arsenite of silver over the surface of the crystal.

ARSENIC ACID. ALKALINE ARSENATES.—Arsenic acid is an artificial product almost entirely confined to the chemical laboratory and to the manufactory. Some authors state that it is a more powerful poison than arsenious acid; others, that it is less poisonous. No fatal case of poisoning by it in the human subject has been recorded. The arsenates of potassium and sodium must be regarded as active poisons, although there are but few instances on record in which life has been destroyed by them.

Analysis.—Arsenic acid is a white non-crystalline deliquescent solid. 1. It is very soluble in water, forming a highly acid solution. 2. It is precipitated of a brick-red colour by ammonio-nitrate of silver.

Sulphides of Arsenic.—Orpiment, or Yellow Arsenic, owes its poisonous properties to the presence of a variable proportion of arsenious acid, sometimes amounting to as much as thirty per cent. of its weight. Orpiment is much employed in the arts, in painting, dyeing, paper-staining, and even in the colouring of toys and sweetmeats for children; but it is not often used as a poison. In the exhumation of the bodies of persons who have died from arsenic, it is common to find the yellow sulphide in the stomach. White may be converted into yellow arsenic in the dead body, but yellow cannot be spontaneously changed into white arsenic.

Orpiment produces *symptoms* and *appearances* similar to those caused by arsenious acid; but the dose required to destroy life varies according to the proportion of arsenious acid with which it happens to be mixed. This is not a common form of poisoning: the yellow colour of the poison would lead to suspicion; but by reason of this colour, orpiment may be given or taken by mistake for mustard or turmeric. The editor has met in his practice with one fatal case. The symptoms differed in no respect from those of a typical case of poisoning by white arsenic.

Analysis.—The powdered sulphide yields a solution of arsenious acid on boiling it in water acidulated with hydrochloric acid. It readily gives the well-known sublimates of metallic arsenic, either with soda-flux or potassium cyanide (see p. 104).

Chloride of Arsenic.—This is a solution of arsenic in diluted hydrochloric acid, used in pharmacy. It contains 4⅓ grains of arsenious acid in one fluid ounce. It is a highly poisonous preparation. In 1857 a woman took, in three doses, thirty minims over a period of twenty-four hours. The quantity of arsenic taken was not more than the *tenth part* of a *grain*, and yet the symptoms which followed were of a severe kind, resembling those of chronic poisoning. These were constriction of the throat, pain and irritation of the stomach and bowels, tingling and numbness of the hands and feet, loss of muscular power, and a feeling of extreme depression. The medicine was withdrawn, and the patient slowly recovered. It seems that she had not taken arsenic previously, and there was no evidence of the existence of a peculiar susceptibility to the effects of arsenic. The quantity taken was very small to produce such alarming symptoms. The usual medicinal dose of this solution is from two to eight minims.

Analysis.—This compound is the product obtained in the separation of arsenic from organic solids by distillation with hydrochloric acid (see p. 109). It may be tested by the processes of Marsh and Reinsch, as there described. When boiled with fuming stannous chloride, it is decomposed, and metallic arsenic of a brown-black colour is deposited.

Arsenetted Hydrogen.—This is a gaseous poison of arsenic, producing when respired, even in small quantity, very serious effects upon the system. It has caused death in several instances among chemists who have incautiously breathed the deadly vapour while performing scientific experiments. Trost has reported three other fatal cases with a full account of the symptoms and appearances. These cases occurred accidentally among workmen engaged in separating silver from lead by means of zinc and hydrochloric acid. The latter was found to contain much arsenic which escaped with the hydrogen. ('Vierteljahrsschr. f. Gerichtl. Med.,' 1873, 1, p. 269. See 'On Poisons.' 'Chem. News,' Dec. 26, 1863, p. 307.)

CHAPTER 12.

POISONING BY MERCURY.—CORROSIVE SUBLIMATE.—SYMPTOMS.—CHRONIC POISONING.—APPEARANCES AFTER DEATH.—CHEMICAL ANALYSIS.—PROCESS FOR MERCURY IN ORGANIC LIQUIDS.—CALOMEL.—WHITE AND RED PRECIPITATES.—OTHER COMPOUNDS OF MERCURY.

Metallic Mercury is not commonly regarded as a poison. It is usually stated that a large quantity of it may be swallowed without affecting health, or without causing more uneasiness than that which may arise from its great weight. It rapidly passes through the bowels. A case which occurred to Gibb shows that this is not strictly true. For the purpose of causing abortion, a girl swallowed four and a half ounces of mercury by weight. It had no effect on the womb, but in a few days the girl suffered from a trembling and shaking of the body (mercurial tremors) and loss of muscular power. These symptoms continued for months, but there was no salivation and no blue mark on the gums. ('Lancet,' 1873, ii. p. 329.) If mercury is breathed or swallowed in a state of *vapour*, or if applied to the skin or mucous membrane in a state of extreme mechanical division, in which state it appears to be easily susceptible of oxidation, it is liable to be absorbed, and to produce a poisonous action on the body. The effects are principally manifested by salivation, trembling and involuntary motions of the limbs, loss of appetite, and emaciation. These symptoms are occasionally seen in workmen engaged in trades in which they are exposed to the inhalation of mercurial vapours.

Corrosive Sublimate.—This substance has received a variety of chemical names. It has been at various times called *Oxymuriate*, *Chloride*, *Bichloride*, *Mercuric Chloride*, and *Perchloride of Mercury*. To prevent any confusion from scientific chemical nomenclature, the old and popular name of *Corrosive Sublimate*, expressing the principal properties of the substance, is here retained. It is commonly seen under the form of heavy crystalline masses, or of a white crystalline powder. Its *taste* is powerfully austere and metallic, so that no poisonous quantity of it could be easily swallowed without the person becoming immediately aware of it. Its solutions, even when very highly diluted—1 in 20,000—have an intensely metallic (coppery) taste. It is very *soluble* in water, hot or cold, and speedily sinks in it, in which properties it differs strikingly from arsenic. At the ordinary temperature it dissolves in about fifteen parts of water; but the poison is more freely soluble in alcoholic liquids.

Symptoms.—The symptoms produced by corrosive sublimate generally come on immediately or within a few minutes after the poison has been swallowed. In the first place, there is perceived a strong metallic taste in the mouth, often described as a coppery taste; and there is, during the act of swallowing, a sense of constriction almost amounting to suffocation, with burning heat in the throat, extending downwards to the stomach. In a few minutes violent pain is felt in the abdomen, increased by pressure, especially in the region of the stomach. There is nausea, with frequent vomiting of long stringy masses of white mucus, mixed with blood, attended with severe pain in the abdomen, and profuse purging. The countenance is sometimes swollen and flushed; in other cases it has been pale and anxious. The pulse is small, frequent, and irregular, and is scarcely perceptible when the symptoms become aggravated. The tongue is white and shrivelled, the skin cold and clammy, the breathing difficult; and death is commonly preceded by fainting, convulsions, or general insensibility. The internal parts of the mouth, when examined, are swollen, and sometimes present a white appearance, as if the cavity had been recently washed with a solution of nitrate of silver; the lips are often swollen. Suppression of urine has been frequently noticed among the symptoms: it existed in a well-marked case of poisoning by this substance, where the patient lived four days, but did not pass any urine during the whole of this time. ('Guy's Hosp. Rep.,' 1844, p. 24.) This symptom was observed in a case reported by Wegeler (Casper's 'Wochenschrift,' 1846, p. 30), in which a youth, æt. 17, swallowed three drachms of the poison, and died on the sixth day. During the last three days no urine was secreted. The case was otherwise remarkable from the fact that no pain was experienced on pressure of the abdomen, and that the pulse underwent no change until shortly before death. In another case, in which twenty grains of corrosive sublimate in solution were swallowed, suppression of urine and salivation came on the third, and the patient died on the ninth day. ('Lancet,' ii. pp. 650, 698.)

The *external* application of corrosive sublimate to tumours or ulcers may destroy life with all the usual symptoms of acute mercurial poisoning. A quack was convicted of manslaughter (Winchester Lent Ass., 1859, *Reg.* v. *Crook*) by applying corrosive sublimate in powder to a cancerous tumour in the face of the deceased. The man died under the usual symptoms. After death the bowels were found extensively inflamed and ulcerated. Corrosive sublimate was detected in the diseased parts. At the Exeter Lent Assizes, 1878, a quack-doctor was indicted for the manslaughter of a woman under similar circumstances. The deceased had ulcers in her legs, and a solution of corrosive sublimate, largely diluted, was applied by the prisoner in order to cure them. The death of the woman was assigned to the absorption of the poison; but the judge held that gross and culpable ignorance had not been proved, and under his direction the prisoner was acquitted. A girl, æt. 9, died from the effects of this poison, locally applied to the scalp for the treatment of ringworm. The liquid applied was alcohol containing eighty grains of corrosive sublimate to the ounce. She suffered from mercurial poisoning in a severe form, and died on the fifth day after the application. ('Pharm. Jour.,' Sept. 9, 1871, p. 216; 'Lancet,' 1871, ii. p. 473; and 'Med. Times and Gaz.,' 1871, p. 353.) No theory of idiosyncrasy is required to account for death under such circumstances. In the first edition of the author's work 'ON POISONS' (1848), p. 394, fatal cases are related of poisoning by corrosive sublimate through the unbroken skin. Two brothers thus lost their lives, the one dying on the fifth and the other on the eleventh day. Those who deny the power of the unbroken skin to absorb corrosive sublimate and cause all the usual effects of acute mercurial poisoning, should make themselves and not their patients the subjects of experiment. Severe salivation sometimes follows the external application of a mercurial compound. A man suffering from eczema of the scrotum was directed to employ black wash, consisting of one drachm of calomel in eight ounces of lime water. In a few days he had fœtor of the breath, swelling and tenderness of the gums, with salivation. ('Brit. Med. Jour.,' 1878, i. p. 367.) In 1884 a man was tried at the Surrey Sessions for putting corrosive sublimate into a kettleful of water. He was acquitted. Several persons suffered from partaking of the poisoned liquid.

Corrosive sublimate differs from arsenic: 1, in having a well-marked taste; 2, in producing violent symptoms in a few minutes; and, 3, in the fact that the evacuations are more frequently mixed with blood. The symptoms produced by corrosive sublimate, in the first instance, resemble those of cholera; if the person should survive several days, they are more like those of dysentery,—violent straining, and shreddy mucous discharges mixed with blood, being frequently observed.

Slow or Chronic Poisoning.—The symptoms are much modified when the poison is taken in small doses at intervals for some days or weeks. There are colicky pains with nausea, vomiting, general uneasiness, and depression. The salivary glands become inflamed and painful; the tongue and gums are red and swollen, sometimes ulcerated, and there is fœtor of the breath. A deep blue line, like that observed in poisoning by lead, is sometimes found around the edges of the gums. The patient experiences difficulty of swallowing and breathing. The constitutional effects are indicated by irritability or looseness of the bowels, difficulty of breathing, spitting of blood, cough, general trembling or convulsive movements of the limbs, and palsy, with fever and emaciation, under which the patient sinks. One of the most marked effects of slow or chronic poisoning by mercurial preparations is *salivation*, or ptyalism, indicated by an increased flow of saliva. This is by no means a necessary symptom in cases of acute poisoning by corrosive sublimate, but it not unfrequently shows itself about the second or third day. In many instances the patient dies too rapidly for this effect to follow; but even when he survives some days, salivation is not always observed. In placing reliance upon this symptom, it must be remembered that salivation may arise from a variety of causes irrespective of the use of mercury. (See 'On Poisons,' 3rd edit. p. 366.) Substances sold under the name of *Worm Lozenges* have been known to cause death by producing fatal salivation. In the salivation caused by mercurial compounds, the saliva always contains mercury, which may be detected by Reinsch's process. The elimination of this metal takes place by all the fluid secretions, but chiefly by the urine and intestinal liquids. ('Lancet,' 1873, i. p. 476.)

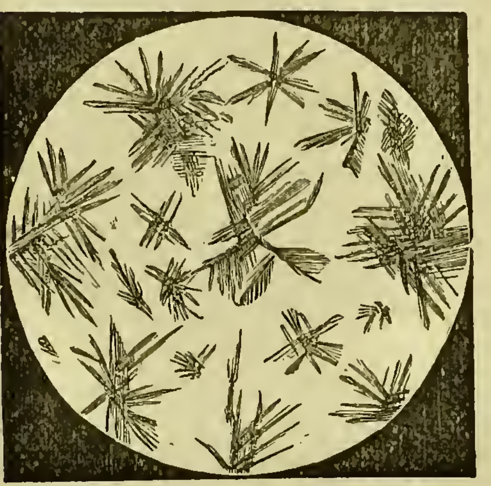
Appearances after Death.—These, as in the case of arsenic, are chiefly confined to the stomach and bowels. Corrosive sublimate, however, affects the mouth, throat, and gullet; the mucous membrane is softened, of a white or bluish-grey colour, and sometimes inflamed; that lining the gullet is similarly affected, and partly corroded and softened. The mucous membrane of the stomach is more or less inflamed, sometimes in patches; and there are masses of black extravasated blood found beneath it. Occasionally this has a slate-grey colour, and the mucous coat beneath may be found reddened. A case occurred in Guy's Hospital, in which the mucous membrane was simply inflamed; it much resembled the condition presented in cases of arsenical poisoning. The coats of the stomach are sometimes corroded, and so much softened that they cannot be removed from the body without laceration. Similar appearances have been met with in the small and large intestines, especially in the cæcum. In a case reported by Herapath, in which twenty grains were taken and death occurred on the ninth day, the mucous membrane of the stomach was softened, but there were no well-marked appearances of the irritant action of the poison on this organ. The cæcum had been the seat of the most violent inflammation, the whole surface being of a deep black-red colour, and there were patches of sloughing in the coats. ('Lancet,' 1845, ii. p. 700; 'Edin. Month. Jour.,' Dec. 1851, p. 532.) Perforation of the stomach is rare as an effect of this poison: there is one case on record. Appearances like those just described have been seen in the intestines, not only where the case has terminated fatally in a few hours, but where it has been protracted for six, eight, and even eleven days.

The *smallest* dose that is reported to have destroyed life is *three* grains. This was in the case of a child, and the quantity was accurately determined from the fact of its having been made up by mistake for three grains of calomel, which a physician had intended to order. It is probable that, under favourable circumstances, from three to five grains, or even less, would destroy an adult.

In an acute case a person commonly dies in from one to five days, but death may take place much sooner or later than this. In the shortest fatal case on record the man died in less than *half an hour*; but the quantity of poison taken was not ascertained. ('On Poisons:' Corrosive Sublimate.)

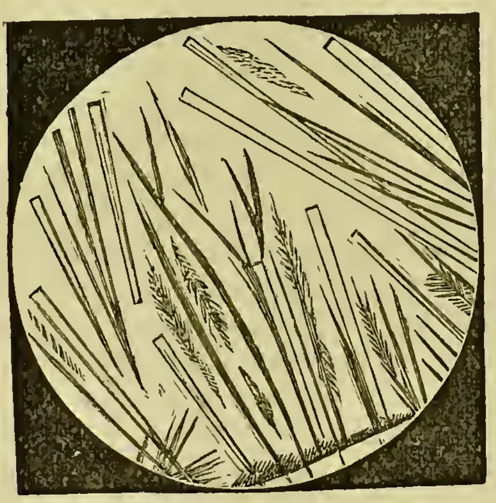
Chemical Analysis.—Corrosive sublimate is usually seen in heavy crystalline masses, or in the form of a white powder. In the *solid* state—1. When the powder is heated on platinum-foil or mica, it melts, and is volatilized in a white vapour without leaving any residue. 2. When heated in a close tube, unlike arsenic, it melts before subliming, and forms a sublimate, consisting of stellated prismatic crystals (see Fig. 12). 3. The powder is changed in colour by the following reagents: iodide of potassium produces a bright scarlet, potash a yellow, and sulphide of ammonium a black compound; ammonia does not alter its colour. 4. The mercury and chlorine may be discovered by one process. Mix the powder with four parts of dried sodium carbonate free from chlorides (obtained by incinerating the bicarbonate), until the residue in the reduction-tube fuses and becomes white. A sublimate of metallic mercury in distinct and well-defined globules will be obtained (see Fig. 14). Detach by a file the end of the tube containing the fused residue, which is sodium chloride with some undecomposed carbonate. Digest it in water with nitric acid, and apply heat until it is entirely dissolved; then add to the solution silver nitrate. A white precipitate of silver chloride, insoluble in nitric acid, will be at once produced. The solid is thus proved to contain both mercury and chlorine, and the only compound of these elements which is soluble in water is corrosive sublimate.

Fig. 12.



Stellated Crystals obtained by heating Corrosive Sublimate, magnified 30 diameters.

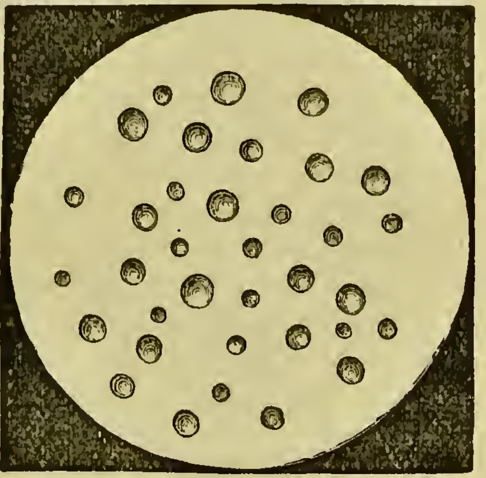
Fig. 13.



Prismatic Crystals of Corrosive Sublimate from a solution in water, magnified 30 diameters.

In *solution* in water. A few drops of the solution of corrosive sublimate evaporated on a glass slide yield slender opaque silky prisms. When a weak solution of potassium iodide is dropped on them, they acquire a bright scarlet colour. This scarlet coloration, which may be obtained from the minutest crystal and only one drop of solution, proves that the body dissolved in water is corrosive sublimate: it is thus distinguished from every other mineral poison, and all other substances whatever. 1. Stannous chloride added to a solution of corrosive sublimate produces a grey precipitate, which, after it has been boiled, is resolved into globules of metallic mercury. 2. Sulphuretted hydrogen and ammonium sulphide produce, after a time, a black sulphide, not soluble in alkalies or diluted acids. 3. If after the liquid has been acidulated with hydrochloric acid, bright copper-foil, wire, or gauze, is plunged into it, the copper will acquire a silvery-white deposit, even in the cold, but more rapidly by heat. When the copper with the metallic deposit is dried and heated in a tube, globules of mercury are sublimed (see Fig. 14).

Fig. 14.



Globules of Mercury.

In organic liquids.—The liquids should be separated by filtration from any insoluble portions. The latter should be pressed, dried, and set aside for a separate analysis. The liquid portion should be slightly acidulated with hydrochloric acid, warmed, and a slip of copper-foil or gauze introduced; if this is not immediately coated with mercury, it may be allowed to remain for some hours. When a deposit has taken place on the copper, it should be removed, washed in water and afterwards in ether, and dried. If the quantity of corrosive sublimate dissolved in an organic liquid is moderately large, it may be removed by means of ether. Place the filtered liquid supposed to contain the dissolved poison in a stoppered tube; add to it twice its volume of ether, and agitate the liquid at intervals for a few minutes. Allow the liquid to subside, pour off the ether into a large watch-glass, and submit it to spontaneous evaporation. As the ether passes off, the corrosive sublimate will be deposited in white silky-looking prisms. These may be purified, if necessary, by solution in water or alcohol, and the solution again crystallized. Corrosive sublimate may thus be separated from arsenic and other mineral poisons in solution. If mercury and arsenic are associated in a poisonous mixture, or in the tissues, the arsenic may be entirely removed by distillation (p. 109). Masses of corrosive sublimate may be sometimes locked up in thick viscid mucus; and, in such cases, the coarse powder being heavy, it may be separated by simply agitating the viscid liquid in water, and then decanting the upper portion suddenly. This poison is decomposed and precipitated by many organic substances, such as albumen, fibrin, mucous membrane; also by gluten, tannin, and other vegetable substances. Thus, then, we cannot always expect to find it in the stomach in a state of solution. Other methods of analysis are chiefly directed to the separation of the mercury only. The suspected liquid is boiled, filtered, and acidulated with hydrochloric acid. 1. To one portion add stannous chloride in excess, again boil the liquid and filter to separate the mercury, the whole of which is precipitated either as a black powder or in grey globules. On boiling this deposit in strong hydrochloric acid, the small globules coalesce to form liquid mercury. 2. Into another portion of the liquid, introduce copper gauze, foil, or wire, and gently warm it. The copper is covered with a layer of silvery-white metal, either immediately or in a few hours. A large quantity of copper may be thus quoted. The coated copper should be digested in warm alcohol or ether, dried and heated in a reduction-tube, when a sublimate in silvery-white globules will be obtained, well marked by their opacity, lustre, and spherical shape when examined with the microscope (see Fig. 14, p. 123). The sublimate of metallic mercury differs from that of arsenic in the fact that, when heated, it sublimes simply as metal without change. It is not oxidized (like metallic arsenic) by heating it in a reduction-tube, but is simply transferred with its metallic lustre and globular form from one part of the tube to another. In the event of a doubt existing respecting the nature of the sublimate, the following experiment will solve it. Cut off by a file the portion of glass on which the globules are deposited; introduce this into a wide short tube, with a few drops of nitric acid. Heat the acid liquid, and evaporate it to dryness on a sand-bath. White crystals will remain, if the sublimate was mercury, and too great a heat has not been applied. On touching the white residue cautiously with a drop of weak solution of iodide of potassium, the crystals will acquire a scarlet colour. In place of copper, a weighed slip of gold-foil may be wound round a rod of zinc, and introduced into the acidulated liquid. The gold is soon covered with a silvery-white layer of mercury. In doubtful cases the deposition may be allowed to go on for twenty-four or even forty-eight hours. The gold-foil must then be detached from the zinc, rinsed successively with water, alcohol, and ether, dried, weighed, and introduced into a reduction-tube. On gently heating the portion of the tube containing the gold-foil, a sublimate of metallic globules of mercury is obtained, and the foil resumes its original yellow colour, and weight. The sublimate must be further examined and tested, as above described.

In the tissues.—Insoluble substances suspected to contain mercury, as well as the soft organs, *e.g.* liver and kidney, may be cut up and boiled in one part of hydrochloric acid and four parts of water until dissolved. The mercury may then be separated by copper or by gold with zinc. This method will show the presence of *mercury*, but not of corrosive sublimate, in the body. Whether the mercurial compound has acted as a poison or not must be determined from symptoms and appearances; whether it has been given or taken as a medicine or not, is a conclusion which must also be determined from other circumstances. The proof that the mercury was really in the form of corrosive sublimate could only be derived from the discovery of some undissolved portions of the solid poison in the stomach or its contents, or from a separation of the poison itself by means of ether. If thus obtained after filtration of an organic liquid, it would show its presence in the form of a soluble salt; and it may be remarked that all the soluble salts are poisonous, and are rarely used internally as medicines. If undissolved, the absorbed mercury may have been derived from some mercurial medicine innocently taken by the deceased. Nothing is more common than to discover traces of mercury in the stomach, bowels, liver, kidneys, or other organs of a dead body. No importance can be attached to this discovery in the absence of evidence that the deceased has actually suffered from symptoms of mercurial poisoning. As to the mercury found in the *tissues*, it may have been derived from a soluble or insoluble compound, or from exposure to the vapours of the metal or of its salts, in various trades.

Calomel. *Mercurous Chloride.*—This substance, although commonly regarded as a mild medicine in small doses, may destroy life, by causing excessive salivation with ulceration and gangrene; and in large doses it acts as an irritant poison.

Analysis.—It is known from corrosive sublimate by its insolubility in water, alcohol, and ether. It is known from white precipitate by its insolubility in acids, and by its being blackened by alkalies. A mercurial sublimate may be obtained from it by heating it with dry sodium carbonate. Under certain conditions, this compound may be changed into corrosive sublimate in the stomach. ('Pharm. Jour.,' Aug. 31, 1878, p. 164.)

White Precipitate. *Ammoniated Mercury.* — The symptoms which this compound produces are violent vomiting, cramps, great thirst, purging and pain in the stomach and bowels, with convulsions. Tenderness of the gums and salivation have been observed among them. After death there is more or less inflammation of the stomach and bowels. Experiments on dogs and rabbits have shown that this is a formidable poison. The greater number of recoveries have been probably owing to the substance being early ejected by vomiting. Rabbits, which do not vomit, were killed by doses of four and five grains in a few hours. After death, mercury was found deposited in various organs, but more in the kidneys than in the other viscera. (For additional facts connected with the action of this poison, see 'Guy's Hosp. Rep.,' 1860, p. 483.) A trial for attempting to poison by this substance took place in 1869. (*Reg.* v. *Seaham,* Maidstone Sum. Ass., 1869.) The compound is white, but, as the result of boiling, it gave a yellow colour to the gruel in which it was administered. In *Reg.* v. *Hargreaves* (Manchester Lent Ass., 1866), a girl was convicted of an attempt to poison her father by this substance. The poison was put into milk and medicine. It produced a burning sensation in the throat and stomach, and thus led to suspicion. About ten grains of white precipitate were detected in some buttermilk.

This substance is very easily procured by children. In Feb. 1873, a boy, æt. 12, was convicted, at the Central Criminal Court, of administering this poison feloniously in medicine. The prosecutor experienced a hot sensation, unlike the bitter taste he had before perceived. A white powder was found in the medicine which proved to be white precipitate.

Analysis.—White precipitate is a chalky-looking compound containing about eighty per cent. of mercury. It is insoluble in water and alcohol. As it is sold in the shops it frequently contains, as an impurity, corrosive sublimate to the amount of one or two per cent., separable by ether or alcohol. It is not used internally, but it is much employed by the poorer classes in the treatment of ringworm. It is soluble in acids, is not blackened by alkalies, and it yields a mercurial sublimate when heated with sodium carbonate. Stannous chloride produces with it a black deposit of mercury. If boiled in a solution of potash, it evolves ammonia, and yellow oxide of mercury is precipitated. It may be detected in organic liquids and solids by boiling them in one part of hydrochloric acid and four parts of water. The mercury may then be separated by means of copper (see p. 124).

Red Precipitate. *Mercuric Oxide. Red Oxide of Mercury.*—This substance is poisonous, but instances of poisoning by it are very rare. One case occurred at Guy's Hospital in 1833. The patient recovered in four days. In another case a woman, æt. 20, swallowed a quantity of beer containing red precipitate. Four hours after she was in a state of stupor, with a weak, irregular, scarcely perceptible pulse, dilated pupils, skin cold and clammy, copious discharge from the mouth. She had vomited once shortly before, and red particles were seen in the ejected fluid. There was pain in the abdomen. Under treatment the symptoms abated, but there was pain in the region of the stomach, a desire to vomit, much salivation, and slight diarrhœa. She gradually recovered. ('Brit. Med. Jour.,' 1878, ii. p. 101.) A case of recovery after the administration of 120 grains has been recently recorded. ('Brit. Med. Jour.,' 1884, i. p. 56.)

Analysis.—By its great weight and insolubility in water, it may be separated from all liquids. Its red colour is characteristic. When heated in a close tube, it is resolved into oxygen and mercury, which is deposited in globules.

Other compounds of mercury, such as the nitrates, sulphates, the cyanide, and sulpho-cyanide have given rise to accidents, and in a few instances have destroyed life, but they very rarely require the notice of a medical practitioner. The sulphide, on account of its insolubility, is probably quite inert.

When heated in a dry state with anhydrous sodium carbonate, all the compounds of mercury yield sublimates of the metal in globules. All the liquid and solid compounds give a dark precipitate of mercury when boiled with stannous chloride.

CHAPTER 13.

POISONING WITH LEAD.—SUGAR OF LEAD—SYMPTOMS.—APPEARANCES AFTER DEATH.—CHEMICAL ANALYSIS.—LEAD IN ORGANIC MIXTURES.—RED LEAD.—CARBONATE OR WHITE LEAD.—CHRONIC POISONING.—POISONING WITH COPPER.—BLUE VITRIOL.—SYMPTOMS.—APPEARANCES.—CHEMICAL ANALYSIS.—COPPER IN ORGANIC LIQUIDS.

Sugar of Lead.

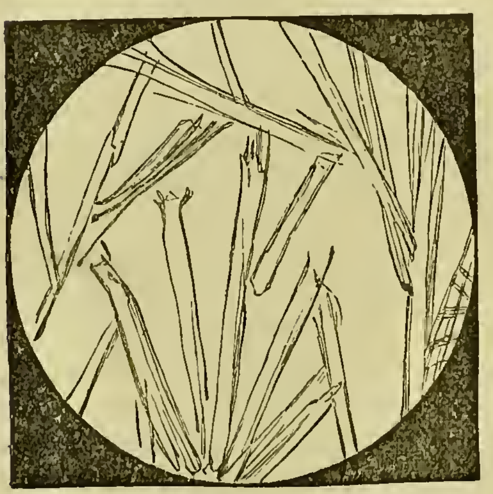
Acetate of Lead.—Symptoms.—Acetate or sugar of lead is by no means an active poison. In medical practice it has often been given in considerable doses without any serious effects resulting. When from one to two ounces have been taken, the following symptoms have been observed: a burning, pricking sensation in the throat, with dryness and thirst, vomiting, and uneasiness at the pit of the stomach, followed by severe colic. The abdomen is tense, and the skin covering it is sometimes drawn in. The pain is intermittent, and relieved by pressure. There is generally constipation of the bowels. If any fæces are passed, they are commonly of a dark colour, indicative of the conversion of a portion of the lead into sulphide. The skin is cold, and there is great prostration of strength. When the case is protracted, the patient has been observed to suffer from cramp in the calves of the legs, pain in the inside of the thighs, numbness, and sometimes paralysis of the limbs. The affection of the nervous system is otherwise indicated by giddiness, torpor, and even coma. A well-marked blue line has been noticed round the margin of the gums, where they join the teeth. (For a remarkable series of cases of poisoning by acetate of lead, see 'Lancet,' 1849, i. p. 478.) In 1882 a woman was convicted (*Reg.* v. *Louisa Jane Taylor*, C. C. C., Dec. 1882) of the murder of Mrs. Tregelles, an aged female, by the repeated administration of acetate of lead. The administration extended over several weeks; and the editor found the body largely impregnated with lead—more especially the stomach. The symptoms were colic, vomiting, blackening of the teeth, paralysis, and at the last epileptoid convulsions.

Appearances.—In one fatal case of acute poisoning the mucous membrane of the stomach was destroyed in several places, especially near the intestinal opening; and most of the intestines were in a state of acute inflammation. In animals, according to Mitscherlich, when the dose is large, the mucous coat of the stomach is attacked and corroded; this change appears to be purely chemical, and takes place in those parts of the body with which the salt of lead comes in contact. If given in a small dose, it is decomposed by the gastric secretions, and exerts no corrosive action on the mucous membrane. When acetate of lead was given in a state of albuminate dissolved in acetic acid, death took place with great rapidity; but on inspection, the stomach was not found corroded. This corrosive action belongs to the neutral salt, and is not manifested when the dose is small or when the poison is combined with an acid. Nothing is actually known concerning the *fatal dose* of this substance; but it may be taken in comparatively large quantity without producing serious effects. Thirty or forty grains have been given daily in divided doses without injury.

Chemical Analysis. Acetate of Lead as a solid.—1. If a portion of the powder is heated in a small reduction-tube, it melts, then becomes solid; again melts, acquiring a dark colour, and gives off vapours of acetic acid, easily recognized by its odour and reaction on litmus-paper. A black mass is left in the tube, consisting of carbon and reduced metallic lead. No sublimate is formed. If heated on mica, yellow lead oxide with reduced metal remains. 2. It is very soluble even in cold water; spring water is turned milky by it, from the presence of carbonic acid and sulphates. 3. A small portion of the powder dropped into a solution of potassium iodide acquires a bright yellow colour. 4. When dropped into solution of potash it remains white. 5. In sulphuretted hydrogen water or ammonium sulphide, it is turned black, in which respect it resembles the white salts of some other metals. 6. When the powder is boiled in a tube with diluted sulphuric acid, acetic acid, known by its odour and volatility, escapes. All these properties taken together, prove that the salt is acetate of lead.

Acetate of Lead in solution.—1. A small quantity, slowly evaporated on a glass slide, will give slender white prismatic crystals, which are turned yellow by potassium iodide, and black by ammonium sulphide. 2. *Diluted sulphuric acid* produces an abundant white precipitate, insoluble in nitric acid, but soluble in hydrochloric acid, and in a large excess of potash. 3. It is precipitated of a yellow colour by *potassium iodide;* the yellow lead iodide is soluble in potash, forming a colourless solution. It is also dissolved by concentrated hydrochloric acid, and by hot water. 4. *Ammonium sulphide,* or sulphuretted hydrogen gas, produces a deep black precipitate, even when less than the 100,000th part of the salt is dissolved. 5. Place a few drops of the solution on clean platinum-foil, acidulate with acetic acid, then apply through the solution, to the surface of the platinum, a thin slip of polished zinc—dark-bluish crystals of metallic lead are instantly deposited on the zinc; by this method a small quantity of the metal may be detected and separated.

Fig. 15.



Crystals of Acetate of Lead, magnified 80 diameters.

Lead in organic liquids.—Acetate of lead is precipitated by many organic substances, especially by albumen and tannin. Thus we may have to analyze either an organic liquid containing lead, or a solid precipitate consisting of mucus or mucous membrane, or albumen intimately united to lead. The liquid should be filtered and examined by a trial test, *i.e.* either by adding to a portion, sulphuric acid, when lead sulphate is precipitated, or by exposing bibulous paper, dipped into the suspected liquid, to a free current of sulphuretted hydrogen gas. If the paper is not stained brown, there is not much lead dissolved; if it is stained brown, we dilute the liquid to destroy its viscidity, should this be necessary, and pass into it a current of washed sulphuretted hydrogen gas until the liquid ceases to be precipitated. The black lead sulphide should be collected on a filter, washed, and dried; then boiled for a quarter of an hour in a mixture of one part of nitric acid diluted with four parts of water. This has the effect of transforming it, at least in part, into lead nitrate, soluble in water. This liquid, when filtered, may be evaporated to dryness, the crystalline residue dissolved in water, and the tests for lead then applied to the solution. If the quantity is too small for the application of all the tests, we may first add sulphuric acid; should a white precipitate be formed, soluble in potash (free from lead), and this alkaline solution be again turned black by ammonium sulphide, this is sufficient evidence of the presence of lead. Should there be no lead dissolved, we must decompose the solid and insoluble matters by boiling them with diluted nitric acid, filter, and test the filtered liquid, previously neutralized; or we may evaporate at once to dryness, destroy the organic matter by heat, and redissolve the residue in nitric acid for testing.

In the tissues.—The organic matter, such as a part of the liver or any other organ, should be *dried*, and afterwards incinerated in a porcelain vessel. The ash should be heated with a small quantity of strong nitric acid, and evaporated to dryness. The dry residue should be digested in a small quantity of distilled water (free from lead), filtered, and, after it has been slightly acidulated with nitric acid, a current of washed sulphuretted hydrogen gas should be passed into it. The production of a brown colour or a brown precipitate in a slightly acid liquid indicates the presence of lead. The precipitate may be dissolved in nitric acid, and further examined (see p. 128). Lead may thus be detected in the dry residue of urine. All liquid and solid organic substances containing lead yield the metal or its oxide by incineration in a porcelain capsule.

Goulard's Extract is a solution of subacetate of lead, containing twenty-four per cent. of the salt; and *Goulard Water* is a mixture of two drachms of this solution in a pint of water. The effects of these compounds, when swallowed or applied locally, are similar to those produced by the acetate, but are more severe.

Red Lead.—This is a mixture or compound of the protoxide and peroxide of lead, much used in the arts. It has occasionally acted as a fatal poison. Dez relates the case of a woman who died from its effects in four or five hours, after convulsions. ('Lond. Med. Rec.,' 1882, p. 117.)

White Lead. *Carbonate of Lead.*—This is an insoluble, chalky-looking compound, which, like other salts of lead, may give rise to the usual symptoms of lead-poisoning. In one instance it appears to have proved fatal. White lead has been used as a cosmetic to give a fair complexion. It is liable to absorption, and to cause the usual symptoms of poisoning. The cosmetic liquid of Madame Rachel consisted of a lead compound with fuller's-earth, starch, and hydrochloric acid. Such a compound applied to the skin clearly would set up irritation in the skin, and be most injurious to health. Most of the cases of poisoning by this substance have been of a chronic character, carbonate of lead being one of the products of the action of water upon lead. Buchner has also reported the history of a family poisoned by lead, accidentally introduced as white lead into flour in a mill. (Friedreich's 'Blätt. f. Gerichtl. Med.,' 1884, p. 161.)

Chronic Poisoning.—Colica Pictonum, or *Painter's Colic*, may be considered as the usual chronic form of poisoning by carbonate of lead. The disease is not, however, confined to an affection of the intestinal canal (colic), though this is the most common symptom. There is a peculiar form of paralysis—lead-paralysis, or '*wrist-drop*;' pains in the joints, often termed 'rheumatic;' and a peculiar form of cerebral affection, of a fatal character, the prominent symptoms of which are epileptoid convulsions, simulating ordinary epilepsy, and ending in coma. The *symptoms* of lead-colic are usually well marked. There is at first pain, with a sense of sinking commonly in or about the region of the navel (the seat of the colon). Next to pain there is obstinate constipation, retraction of the skin of the abdomen, loss of appetite, thirst, a fœtid odour of the breath, and general emaciation; with paralysis of a peculiar kind affecting the extensor muscles, and causing a dropping of the wrist, or showing itself in a general paralysis of the limbs. The skin acquires a sallow colour, generally well marked in the face; and the patient experiences a sweetish, styptic, or astringent taste in the mouth. A symptom of a peculiar nature was first pointed out by Burton ('Med. Gaz.,' vol. 25, p. 687), namely, a *blueness* of the edges of the *gums*, where these join the bodies of the teeth; the teeth are of a brownish colour. The blue line on the gums may be regarded as a distinguishing sign of lead-poisoning. It is owing to the deposition of lead in these structures—a fact proved by the action of chromic acid on the excised gums. They acquire a yellow colour (chromate of lead), and, when afterwards treated with an alkaline sulphide, they become black from the formation of sulphide of lead. ('Lancet,' 1878, i. p. 913.)

Lead-palsy usually comes on after several attacks of colic. It shows itself first, and most prominently, in the extensor muscles of the forearm—the muscles supplied by the musculo-spiral nerve; hence the *supinator longus* muscle escapes. The disease, however, is not always confined to the forearm. The dropped hand, and the inability to raise it, gives rise to the term 'dropped wrist.' Epileptoid convulsions ending in coma are a rare and usually late affection, in severe cases, as *e.g.* among workers in white-lead factories, and is commonly a fatal affection. The editor has met with several such cases.

Hair-washes generally contain a salt of lead in solution. The use of them may lead to all the symptoms of chronic lead-poisoning.

Chronic poisoning with lead often kills the patient, since a great amount of mischief is usually done before the cause is discovered. The only *appearances* found after death have been a contraction of the cavity of the large and small intestines, and a considerable thickening of their coats. These changes have been especially noticed in the colon—the seat of colic. The various circumstances under which this form of poisoning is liable to occur are elsewhere fully described. (See 'On Poisons,' p. 409.)

One of the most frequent causes of chronic lead-poisoning is the use of water kept in leaden cisterns or pipes; or the careless employment of white or red lead as a cement for pipes and cisterns. For an instructive series of cases showing the effects of water thus poisoned, the reader is referred to a paper by De Mussy. ('Dublin Quar. Jour.,' May 1849; also 'Med. Gaz.,' vol. 44, p. 260.) These cases occurred at Claremont, among the members of the ex-royal family of France. The effects were traced to the use of pure water which had acquired an impregnation of lead by contact with that metal, in the proportion of one grain to the gallon. Thirteen out of thirty-eight persons were affected, and to such a degree that the nails of the toes and fingers in some acquired a bluish discoloration. The children of the family did not suffer. No symptoms appeared until after the water had been in use for a period of from five to seven months, and more than half of those who used the water escaped any ill effects. The presence of lead in public water-supplies has recently attracted great attention, in consequence of the pollution of the supplies of Keighley and Huddersfield. It appears that soft waters, especially if ferruginous, are very prone to act injuriously upon leaden pipes. ('Lond. Med. Rec.,' 1882, p. 420; 'Chem. News,' 1882, ii. p. 88.)

Cases of poisoning are sometimes observed as the result of the accidental introduction of lead into the system in wine, beer, cider, milk, lemonade, and other liquids. Earthenware glazed with litharge imparts oxide of lead to fat in dripping, also to acid liquids. Snuff is sometimes adulterated with *red lead* to improve its colour, and some cases of lead-poisoning have occurred from the use of such snuff.

A spurious tinfoil, consisting chiefly of lead faced with tin, is much used as a covering or wrapper for articles of food. When exposed to damp, this metallic alloy undergoes chemical changes whereby carbonate of lead is produced. Children's farinaceous food has thus become impregnated with carbonate of lead. In tinned iron vessels there is often a large quantity of lead combined with the tin, as it is a much cheaper metal. Hamilton has noticed that lead-poisoning has been produced in India by the use of the tinned cooking-pots. ('Lancet,' 1877, i. p. 253.)

There is another unsuspected method by which lead may find its way into that common article of food—flour. It is sometimes a custom of millers to repair the holes in their millstones with melted lead. The lead is thus carefully ground into and mixed with the flour. Alford states that fifteen or twenty persons, in different families, suffered from colic, and other symptoms of chronic lead-poisoning, from this cause. The blue line on the gums was well marked. It was found that they had all had their own corn ground at the same mill. On examining the millstones, they were found to be honey-combed with lead. There was on the surface of the stones about ten pounds of lead. ('Brit. Med. Jour.,' 1877, i. p. 627.)

The workers in white lead, especially those engaged in the operation of stoving and grinding the compound, are most prone to suffer in a severe form from lead-poisoning. This has been made a matter of recent legislation, in order to protect the workpeople from the insidious effects of lead compounds.

Copper.

All the salts of copper are poisonous. The two most commonly known in commerce are the Sulphate, or Blue Vitriol, and the Subacetate, or Verdigris.

Blue Vitriol. *Sulphate of Copper.—Symptoms.*—Sulphate of copper has been frequently given for the purpose of procuring abortion. In doses of half an ounce and upwards it acts as an irritant on adults, and a much smaller quantity would suffice to destroy infants or children. The salt speedily causes vomiting of the most violent kind; this sometimes expels the poison from the stomach, and the person recovers. There is headache, with colicky pains in the abdomen and purging; and in aggravated cases there are spasms of the extremities and convulsions. Perceval met with an instance in which violent convulsions were produced in a young woman by sixty grains of sulphate of copper. Paralysis, insensibility, and even tetanus, have preceded death, when the poison was administered to animals. Among the symptoms occasionally met with in the human being may be mentioned jaundice. This has been observed to attend poisoning with the sulphate, as well as by Scheele's green. Two children, one eight and the other six years old, ate a quantity of wheat which had been washed in a solution of sulphate of copper. They were seized with incessant vomiting, the vomited matter being of a bluish or greenish colour. The vomiting continued more or less for several days. There was no purging. The elder child recovered, but the younger was very much prostrated, and died about two months afterwards. ('Brit. Med. Jour.,' 1877, ii. p. 292.) In 1884 a girl was convicted of poisoning her mistress by introducing sulphate of copper into a jug of beer. The taste of the substance was perceived; the only results were severe vomiting. (*Reg.* v. *Mary Baker*, C. C. C., Oct. 1884.) The *vomited* matters are remarkable for being generally of a *blue* or *green* colour; broken crystals of blue vitriol were discovered in them in a case in which the poison was taken in the state of coarse powder. If the green colour of the vomited liquid is owing to altered bile, it will not acquire a blue tint on adding to a portion of it a solution of ammonia; but if caused by a salt of copper, this change of colour will serve to indicate the fact. The medicinal dose of sulphate of copper as an emetic is from five to fifteen grains, and, as a tonic, from one to three or four grains.

Verdigris, or subacetate of copper, in large doses, produces similar symptoms.

Chronic poisoning by copper is occasionally seen among workers in this metal and its salts. The poison enters the system partly by the lungs in the form of dust, and partly by the skin in handling the metal or its salts. The marked symptoms are a coppery taste in the mouth, giddiness, pain in the bowels, vomiting, occasional diarrhœa, and wasting of the body. Clapton has pointed out another symptom, namely, a green line on the margin of the gums. He met with this in a sailor and in some working coppersmiths. ('Med.

Times and Gaz.,' 1868, i. p. 658.) The author saw two of these cases in 1868. The green line was well marked. The men brought with them a hammer used in their work. It had a greenish colour, and this was proved by tests to be owing to the presence of copper. The perspiration from the hands in working had converted the copper into basic chloride, and had thus led to its absorption by the skin. Several cases of chronic poisoning by copper, among coppersmiths, have been treated by Cameron, but this symptom was not noticed. ('Med. Times and Gaz.,' 1871, 1, 581.) Galippe (*Sur le Cuivre*) denies the injurious action of copper compounds upon the human body. Cases have, however, been observed of the injurious effects of preserved vegetables, the green colour of which was formerly preserved by the use of sulphate of copper.

Appearances.—In the few fatal cases which have been hitherto examined, the mucous membrane of the stomach and intestines has been found more or less thickened and inflamed; and in some cases eroded and softened. The gullet has presented an inflammatory appearance. In one case of poisoning by verdigris the stomach was inflamed and thickened, especially towards the intestinal opening, the orifice of which, from the general thickening, was almost obliterated. The small intestines were throughout inflamed, and perforation had taken place, so that part of the green liquid was effused into the abdomen. The large intestines were distended in some parts, and contracted in others, and the rectum was ulcerated on its inner surface. (Orfila, 'Toxicologie.') The lining membrane of the intestines has been found throughout of a deep-green colour, owing to small particles of the copper salt (verdigris) adhering to it.

Chemical Analysis.—The salts of copper, whether in the solid state or in solution, are generally known by their blue or green colour. *Tests.*—1. *Solution of Ammonia* gives, in a solution of a salt of copper, a bluish-white precipitate, which is soluble in an excess of the test, forming a deep violet-blue liquid. 2. *Ferrocyanide of potassium* gives, in a very diluted solution, a rich claret-red precipitate. If the quantity of copper is small, the liquid acquires merely a light-red colour; if large, the precipitate is of a deep red-brown colour, and of a gelatinous consistency. Ferrocyanide of potassium will act on the violet-blue solution produced by ammonia, provided a few drops of acetic acid are added in order to neutralize the ammonia. One portion of the liquid may thus be tried with the two tests. 3. *Sulphuretted hydrogen gas* and sulphide of ammonium give a deep chocolate-brown precipitate, even in an acid solution; or, if the copper is in small proportion, merely a light-brown colour. 4. A slip of *polished iron* (a common needle) suspended by a thread in the liquid slightly acidulated with sulphuric acid, is speedily coated with a red layer of copper, even when the salt is in very small proportion. The iron thus coated may be washed, immersed in ammonia, and exposed to air. The liquid becomes slowly blue. A minute quantity of copper may be thus easily detected. 5. *The electrolytic test.* If a few drops of the copper-solution are placed on platinum-foil, slightly acidulated with a diluted acid, and the platinum is then touched through the solution with a rod of zinc, metallic copper, of its well-known red colour, is immediately deposited on the platinum. When the quantity of copper is very small, there is merely a brown stain; but a blue liquid is formed by pouring on it ammonia, and exposing it to air. A coil of fine platinum and zinc wires may be substituted for the foil.

Copper in organic liquids.—Copper is liable to be precipitated by certain organic principles, *e.g.* albumen, fibrin, and mucous membrane; but some of these organic compounds are easily dissolved by acids, or even by an excess of the solution of copper salt. A portion at least of the salt of copper is, therefore, commonly held dissolved. In such cases the liquid is usually of a *greenish colour*, and has a strong coppery or metallic taste, even when the copper salt is in far less than a poisonous proportion. Having filtered the organic liquid, let a portion of it be placed in a clean platinum capsule. A few drops of diluted sulphuric acid should be added, and a rod of zinc introduced. Wherever the platinum is touched by the zinc, metallic copper is deposited; and, after having in this way coated the platinum capsule, the surplus liquid may be poured off and the capsule well washed out. The deposited copper, which is of a deep-red colour, is then dissolved in nitric acid, and the tests are applied after the excess of acid has been driven off by heat, and the residue dissolved in water. In place of nitric acid and heat, a solution of ammonia may be poured on the metallic deposit in the cold. Under exposure to air the metal is oxidized and dissolved in a few minutes, forming a blue solution. This ammoniacal solution may be neutralized with acetic acid, and the ferrocyanide of potassium then applied. The red colour of the deposit on platinum is characteristic of copper, but the mode of testing here advised renders the results conclusive.

In the tissues.—Dry and incinerate the organic matter over a Bunsen burner provided with an *iron* tube. If the ordinary burner with *brass* tube be used, some copper will be volatilized from the burner and deposited on the ashes. Digest the residuary ash in pure hydrochloric acid by heat, and then evaporate nearly to dryness. This residue may be dissolved in a small quantity of water, and a polished needle immersed in it for some hours. The metallic deposit, if any, on the needle may be recognized as copper, either by its colour or by the action of ammonia.

Traces of copper have been found in many kinds of food, as well as in the tissues of the body, irrespective of the introduction of a copper salt as a poison. Thus copper has been detected in various green pickles, in preserved peas and other vegetables. It has been used in these cases as an artificial colouring. In prosecutions under the Sale of Food and Drugs Act, the question has arisen whether the quantity of copper (0·28 grain in a pound) would render the article injurious as food. Copper is a noxious substance, and there is a penalty on the wilful admixture of any noxious substance with any article intended for food, whatever the proportion may be. In some cases, a grain and a half of sulphate of copper has been found in a pound of peas. If a non-poisonous dose of white arsenic improved the appearance of cream, this would be no justification for its introduction into this article of food, nor any reasonable answer to the charge of selling food containing a poisonous ingredient.

CHAPTER 14.

TARTAR EMETIC. — ANTIMONIAL WINE. — SYMPTOMS. — APPEARANCES. — CHRONIC POISONING. — CHEMICAL ANALYSIS. — CHLORIDE OR BUTTER OF ANTIMONY. — POISONING WITH SALTS OF ZINC AND IRON. — POISONING WITH CHROMATES.

Tartar Emetic.

Tartar Emetic, or *Tartarated Antimony*, is met with in commerce as a heavyish white powder, freely soluble in twenty parts of water and is less soluble in alcoholic liquids. It is used in medicine, and more largely in veterinary medicine.

Antimonial Wine, *i.e.* the official solution of tartarated antimony in sherry wine (two grains in one fluid ounce), may easily be mistaken for ordinary sherry. The editor had an assistant who was made seriously ill by drinking this medicine, which he had pilfered. Tartar emetic is a constituent of many proprietary and patent cough medicines; and these, when taken in excess, may produce a powerful depressant action upon the system.

Symptoms and Effects.—When tartar emetic is taken in a poisonous dose, a strong metallic taste is perceived in the mouth during the act of swallowing. There is great heat, with constriction of the throat and difficulty of swallowing, violent burning pain in the region of the stomach, followed by incessant vomiting, profuse purging, faintness, and extreme depression. The pulse is small and rapid, sometimes imperceptible; the skin cold, and covered with a clammy perspiration; and the respiration is painful. Should the case prove fatal, death may be preceded by giddiness, insensibility, great prostration of strength, and sometimes violent spasms of the muscles of the limbs, which may assume either a clonic or a tetanic character. Such are the symptoms in an acute case of poisoning by this substance. The *quantity* actually required to destroy life is small. One drachm taken at a dose proved fatal in ten hours, in spite of early and frequent vomiting. ('Med. Gaz.,' vol. 45, p. 801.) In a case in which a girl took a teaspoonful of tartar emetic by mistake, recovery took place in three weeks. She suffered from enteritis, and, as an after-effect, her hair fell off. ('Brit. Med. Jour.,' 1876, ii. p. 492.) A man took eighty grains. There was only slight vomiting an hour after he had taken it, but this became subsequently very violent, attended with severe cramps in the legs, and profuse perspiration. He recovered in two days. ('Brit. Med. Jour.,' 1877, i. p. 674.) In 1881 a young man was killed in six hours by a dose of fifteen grains of tartar emetic. The characteristic pustular eruption of tartar emetic, often observed on the skin after its local application, was found on the mucous membrane of the stomach. (Friedreich's 'Blätt. f. Gerichtl. Med.,' 1882, p. 8.)

On April 18, 1876, *Mr. Bravo*, æt. 30, a barrister, was poisoned by tartar emetic. After dining with his wife, and whilst alone in his room, at 6.30 p.m., he was suddenly seized with violent sickness and vomiting. When seen at 10.30 p.m., by Moore, he was lying back in a chair, totally unconscious; the breathing was noisy, and the heart's action was barely perceptible. He did not appear to suffer pain, and his appearance was not unlike that of a person under the effects of a narcotic. He had previously complained of pain in the stomach, and an emetic of mustard and water had been given. The pupils were widely dilated; and he was unable to swallow, when seen shortly afterwards by Harrison. At 1.45 a.m. he first vomited blood. At 3.30 a.m. on the 19th, soon after he was seen by Geo. Johnson and Royes Bell, a little consciousness returned; and he then said, to account for his state, that he had rubbed his gums with laudanum, and that he might have taken some of this liquid. Just before becoming conscious, viz. at 2.45 a.m., he vomited blood, and passed bloody stools. Throughout the 19th, after the return of consciousness, he suffered excruciating pain, and was violently purged, and vomited frequently. On the 20th the patient was seen by Gull, at 6.30 p.m., who found him pulseless and dying. He was told that he was dying of poison, and was asked how he came by it. He replied, 'I took it myself.' 'What did you take?' 'Laudanum.' When told that he had taken more than laudanum, he made no further statement bearing upon the matter, except to repeat a second time, 'I took it myself.' Pain, collapse, vomiting, purging, and occasional convulsions, especially of the upper limbs, continued till near the close, when the vomiting and purging ceased. He died on the 21st of April, fifty-five hours after the commencement of symptoms. At the autopsy, made next day, the following appearances were observed by Payne: There was no appearance of inflammation, congestion, or ulceration. The stomach contained about eight ounces of thick gruel-like matter of a yellowish colour, containing small solid lumps, and had the odour of alcoholic fermentation. The gullet was natural, and contained some of the same matter as the stomach. The first portion of the bowels was very soft, being torn in tying it; but subsequent careful examination showed no perforation or ulceration. The surface was pale and yellowish like that of the stomach. The whole of the small intestine was like this, except the lower part, where there were some red spots. This part of the bowels contained yellow pasty matter without any admixture of blood. Subsequent examination showed several small ulcers in the cæcum, from which the bleeding had evidently taken place, but there was no perforation. The remainder of the large intestine was very deeply blood-stained, but without ulceration. The contents were a soft dark-red material, composed of fæcal matter mixed with blood. The liver and spleen were natural, as were also the pancreas, kidneys, and other abdominal organs. The skull, and the membranes of the brain, were quite natural, containing only the usual amount of blood. The brain-substance was also healthy, and contained no excessive amount either of blood or of watery fluid. The mouth and lips were natural, except that the papillæ at the back of the tongue were somewhat more prominent than usual. There was no other appearance of disease in the body, except what has been noted. From the first vomit of the deceased, Redwood obtained antimony equivalent to ten grains of tartar emetic. Antimony was also detected in the liver, and in fluid taken from the large intestines of the deceased, but not in the contents of the stomach. Traces of the metal were also discovered in the urine passed during life. Redwood was of opinion that at least twenty grains of tartaric emetic had been taken by deceased. A verdict of wilful murder by some unknown person was returned, no tartar emetic being traced into the hands of the deceased or any person about him. It was also known that Bravo was well read in medical jurisprudence, and was acquainted with the poisonous nature of tartar emetic. Some months after the return of the above verdict, evidence came into the possession of the editor—who watched the medical aspect of the case at the inquest on behalf of one of the persons living in the same house as deceased—showing that Bravo had tartar emetic in his possession within six or seven weeks of his decease. He had purchased a large number of quack powders, extensively advertised as a cure for dipsomania, and received instructions that these, if administered too freely to his wife, would cause vomiting. It is possible that these powders—each of them consisting of half a grain of tartar emetic with a pink vegetable pigment—may have been taken in fatal amount by the deceased, who was unaware of their poisonous nature, for the purpose of causing ejection of the laudanum which he had admittedly taken. It is probable that the laudanum would delay the ejection of the tartar emetic, and thus increase the liability to a fatal result.

Appearances.—The following cases, as well as those already given, show the nature of the appearances likely to be found after death: Two children, a boy aged five, and a girl aged three years, each swallowed a powder containing *ten grains* of tartar emetic mixed with a little sugar. It was stated that, in twenty minutes after taking the powders, they were seized with violent vomiting and purging, and great prostration of strength, followed by convulsions and tetanic spasms; there was also great thirst. The boy died eight hours, and the girl twelve or thirteen hours, after swallowing the dose. The bodies were inspected between four and five days after death. In that of the boy there was effusion of serum in the right pleura; the lower lobe of the right lung posteriorly was redder than natural, and the peritoneum was injected from recent inflammation. The mucous membrane of the duodenum was inflamed, and covered with a whitish-yellow viscid secretion; this was observed throughout the intestines, but the colour was of a deeper yellow in the large intestines; there was no ulceration. The peritoneal coat of the stomach was inflamed. The mucous membrane of this organ was also much inflamed, especially about the larger curvature and at the cardiac orifice; there was no ulceration, but in one case there was a patch of lymph. The stomach contained about two ounces and a half of a dark bloody fluid, having a slightly acid reaction. The tests used did not indicate the presence of antimony. With regard to other appearances, the tongue was covered with a white fur, and appeared soddened; the throat was not inflamed; the windpipe and gullet had a natural appearance. On opening the head, the dura mater was found congested; the longitudinal sinus contained a coagulum of lymph, and but little blood. The vessels of the surface of the brain were much injected with dark-coloured blood, the whole surface having a deep purple colour. Every portion of the brain, when cut, presented many bloody points. The cerebellum and medulla oblongata were also congested; there was no effusion in the ventricles or at the base of the brain. In the body of the girl the morbid appearances were similar; there were, in addition, on the arms, legs, and neck, patches resembling the eruption of scarlatina. The arachnoid membrane was more opaque than usual; and on the mucous membrane of the stomach, where the inflammation was greatest, were two or three white spots, each about the size of a split pea, which appeared to be the commencement of ulceration. ('Lancet,' 1846, ii. p. 460. See also case of Bravo, p. 136.)

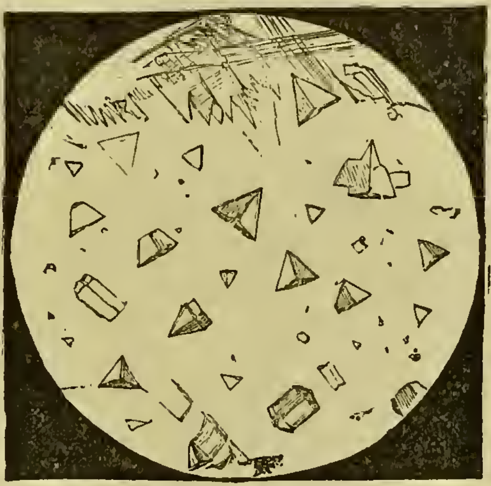
In cases of *chronic poisoning* by this substance, the principal symptoms are as follows: Great nausea; vomiting of mucous and bilious liquids; great depression and prostration of strength; watery purging, followed often by constipation of the bowels; small, contracted, and frequent pulse; loss of voice and muscular strength; coldness of the skin, with clammy perspiration; and death from complete exhaustion. In these cases antimony may be detected in the urine by Reinsch's process. There are several cases reported which show that tartar emetic has been thus criminally employed. (See 'Brit. Med. Jour.,' 1876, i. p. 639.)

It has been supposed that the cases in which this poison has proved fatal have been few; but the author has elsewhere reported thirty-seven, of which sixteen were fatal. The smallest fatal dose was, in a child, *three-quarters of a grain* ('Jour. de Chimie,' 1847, p. 472), and in an adult, *two grains*; but in this latter instance there were circumstances which favoured the fatal operation of the poison. ('Guy's Hosp. Rep.,' 1857, p. 415; Andral's 'Clinique Méd.,' 1836, p. 698.)

Chemical Analysis. Tartar Emetic as a solid.—In the state of powder it is white and crystalline.—1. It is easily dissolved by water; the solution has a faintly acid reaction, and an acrid metallic taste. 2. The powder, dropped into sulphide of ammonium, is turned of a deep reddish-brown colour, and is thereby known from other white metallic salts. 3. When heated in a reduction-tube, it is charred, but does not previously melt, like acetate of lead. The metal is partially reduced by the carbon of the vegetable acid, and the decomposed mass has a greyish-blue metallic lustre. No metallic sublimate is produced in this experiment by the moderate heat of a spirit-lamp. 4. When boiled in water containing one-sixth of pure hydrochloric acid, and metallic copper is immersed in the liquid, a deposit of antimony takes place on this metal. The colour of the deposit is violet-red if the quantity is very small, but the deposit is grey, or black and pulverulent, if very large. 5. The solution acidulated with one-tenth part of hydrochloric acid gives in the cold a black deposit on a surface of pure tinfoil. This serves to distinguish antimony from arsenic, which, under these circumstances, produces no deposit on *pure* tin. On the other hand, tartar emetic and other antimonial compounds give no deposit when boiled with stannous chloride and fuming hydrochloric acid, unless arsenic is present as an impurity.

Tartar Emetic in solution.—1. On slowly evaporating a small quantity of the solution on a slip of glass, the salt will crystallize in *tetrahedra,* and in derivatives of the octahedron (Fig. 16). If obtained from a very diluted solution, this crystallization is confused, and resembles that of arsenic. 2. *Hydrochloric, nitric,* or *sulphuric acid,* each gives a white precipitate, soluble in excess of the acid. This triple reaction is very characteristic of tartarated antimony. 3. *Ferrocyanide of potassium* does not precipitate the solution, whereby tartar emetic is known from most other metallic poisons. 4. *Sulphuretted hydrogen gas* produces in the solution a reddish-orange coloured precipitate, differing in colour from every other metallic sulphide. This precipitate is soluble in ammonium sulphide, and is dissolved by strong boiling hydrochloric acid.

Fig. 16.



Crystals of Tartar Emetic, magnified 30 diameters.

In liquids containing organic matter.—Tartar emetic is precipitated by tannin in all its forms, but not readily by albumen or mucous membrane; therefore it may be found sometimes dissolved in the liquids of the stomach, and sometimes precipitated. These insoluble compounds of antimony are soluble in tartaric acid; and thus, if there should be no antimony dissolved, it may easily be brought into a state of solution by means of this acid. The liquid, acidulated with tartaric acid, should be boiled and filtered. If it should be highly coloured or turbid, it may be concentrated and submitted to the process of dialysis. The antimonial compound may thus be obtained in a clear solution. A current of sulphuretted gas may now be passed into the whole or a portion of it until there is no further precipitation. The sulphide is collected, washed, and dried. If it is the sulphide of antimony, it will have an orange-red or brown colour, it will be insoluble in a solution of ammonia, and when dried will be dissolved by a small quantity of boiling hydrochloric acid (forming chloride of antimony), with the evolution of sulphuretted hydrogen gas. The boiling should be continued for several minutes until the liquid is colourless. On adding this solution, if not too acid, to water, a white precipitate of oxychloride of antimony falls down. The white precipitate is soluble in tartaric acid. This is characteristic of antimony. If the sulphuretted hydrogen is passed into a coloured organic liquid, the orange-red colour of the sulphide can be only well seen in the froth.

The following method of detecting the metal when dissolved in any organic liquid, is based upon the principle by which copper and other metals may be detected under similar circumstances. Acidulate a portion of the suspected liquid with hydrochloric acid, and place it in a shallow plantinum capsule. Touch the platinum, through the acid liquid, with a rod of pure zinc. Hydrogen is evolved, and, wherever the metals come in contact, metallic antimony, in the state of a black powder, is deposited upon the surface of the platinum. The liquid should be poured off, and the capsule thoroughly washed with distilled water. This may be effected without disturbing the black deposit. This deposit should be heated with strong nitric acid—evaporated to dryness—the white residue dissolved in strong hydrochloric acid, and this solution, not too much diluted, may be precipitated by a current of sulphuretted hydrogen. A reddish-coloured sulphide indicates antimony. If a portion of this hydrochloric acid solution is added to water, it may give a precipitate of white oxychloride of antimony, soluble in tartaric acid, and this solution may be precipitated of an orange-red colour by sulphuretted hydrogen. By this process antimony in small quantity may be detected in, and separated from, any liquid containing organic matter. If there is no deposit under these circumstances, a rod of zinc or a piece of tinfoil, with a layer of thin platinum-foil wound round it, should be suspended in the sufficiently diluted acid liquid for some hours. If antimony is present, it will be deposited on both metals in the form of a black powder.

In the tissues.—The antimony may be deposited in the organs in so small a quantity that neither the sulphuretted hydrogen nor the deposition on platinum process will yield any satisfactory results. The liver or other organ should be cut into small pieces, and boiled in a mixture of one part of hydrochloric acid and five parts of water. After some time, the liquid may be tested by introducing into it a slip of polished copper-foil free from antimony. If antimony is present in small quantity, the copper will acquire a reddish or violet-coloured deposit on its surface; if in large quantity, the deposit will be grey with a metallic lustre, or sometimes in the state of a loose black powder. These deposits, when heated in a reduction-tube, do not yield octahedral crystals like those obtained from arsenic. A slip of pure tinfoil may be suspended in the cold acid liquid, so diluted that the hydrochloric acid forms only one-tenth part by measure. Either immediately, or in the course of a few hours, if antimony is present, the tin is covered with a black deposit of the metal. Antimony in the metallic state is so easily procured from a small quantity of material, by one or other of the above-mentioned processes, that on no account should this be omitted. The procuring of the metal may be made subsidiary to the procuring of the sulphide, as the metal can be easily oxidized and made soluble by boiling the deposit on copper with a solution of permanganate of potassium. It can then be converted into sulphide, and obtained entirely free from organic matter. A reliance on a small quantity of a coloured precipitate from sulphuretted hydrogen alone, without the production of the metal in some form, would be most unsatisfactory as chemical evidence. No chemist would rely upon the production of a yellow sulphide as certain evidence of the presence of arsenic, unless he obtained the metal arsenic from that compound.

The separation of antimony from the tissues does not necessarily indicate that it has been criminally administered or has caused death; but its presence there should be reasonably accounted for, as antimony may have been unlawfully administered. In several cases of suspected death from poison, deposits on copper, evidently of an antimonial nature, have been obtained from the liver or tissues. On inquiry it has been found that antimonial medicines had been taken shortly before death. It is best, however, in all cases to shred up the tissue, and boil it with dilute hydrochloric acid, a few crystals of potassium chlorate being introduced from time to time, till a clearish yellow solution is obtained. The solution is then warmed with sodium bisulphite till it persistently smells of sulphur dioxide. The whole is then allowed to stand in a warm place till the sulphur dioxide has disappeared. The liquid is filtered, and the filtrate precipitated with a stream of washed sulphuretted hydrogen gas. A precipitate of sulphide of antimony falls, mixed with sulphur. This may be dissolved in boiling strong hydrochloric acid, and tested as above for antimony.

Terchloride, or Butter of Antimony.—This is a strongly corrosive poison. It is used for browning gun-barrels, and in veterinary medicine. It has caused death in several instances. Two women, mother and daughter, were tried (Worcester Sum. Ass., 1883, *Reg.* v. *Wallis and Wallis*) for the murder of the illegitimate infant child of the younger prisoner by means of terchloride of antimony, but were acquitted from insufficient evidence of administration. It was at first supposed that the child had died from poisoning by ferric chloride, which was detected in the stomach by a medical man. The editor found antimony in the viscera, and also in the matters vomited and passed from the bowels of the child. The ferric chloride was merely the impurity always met with in commercial terchloride of antimony. The symptoms and appearances resemble those produced by concentrated hydrochloric acid. The terchloride gives a white precipitate when added to water. This is soluble in tartaric acid, and the solution is precipitated of an orange-red colour by sulphuretted hydrogen gas. It has caused death in several instances.

ZINC.

Sulphate of Zinc. White Vitriol.—Symptoms and Appearances.—The symptoms produced by an overdose of sulphate of zinc are pain in the abdomen and violent vomiting, coming on almost immediately, followed by purging. After death the stomach has been found inflamed. The sulphate appears to act as a pure irritant; it has no corrosive properties. This salt may cause death indirectly as the result of exhaustion from violent vomiting, when an ordinary dose has been given to a person already debilitated by disease. It does not appear to be a very energetic poison. In one case a lady recovered after taking sixty-seven grains. ('Lancet,' 1856, i. p. 540.) In another, which occurred in 1872, communicated to the author by Mackintosh, of Downham, a man, æt. 20, recovered in a few days after taking an ounce of sulphate of zinc by mistake for Epsom salts. There was early vomiting and purging of a most violent kind, with great prostration of strength. The greater part of this large dose was no doubt thus carried out of the body.

Chloride of Zinc.—Symptoms and Appearances.—This, which is commonly sold under the name of 'Sir W. Burnett's fluid,' is a corrosive and irritant poison, and is much used as a deodorizer. The patient experiences a sense of heat and burning in the mouth and throat, in the act of swallowing the liquid, which has been frequently fatally mistaken for fluid magnesia. There is a burning and griping pain in the stomach, and nausea, followed usually by violent retching and vomiting —the vomited matters being streaked with blood and mixed with much flaky mucus, with shreds of mucous membrane. This has produced an appearance of frothiness about the mouth. Violent purging has been observed among the symptoms. A stage of collapse supervenes, and the skin becomes cold and livid.

A man, æt. 62, took two fluid ounces of soldering fluid, made by dissolving zinc in hydrochloric acid—and hence a solution of chloride of zinc. An emetic was given without effect, and he speedily became collapsed. There was profuse purging. A little scanty urine was drawn off by a catheter. He retained his intellect till death, four hours and a half after taking the poison. Crosse found after death the tongue white and shrivelled; and the mucous membrane of the mouth as if charred. The gullet was contracted with the mucous membrane, white, silky, and easily detached. The stomach was contracted and rugose, the mucous membrane being of an ashy-grey colour, with black patches. The stomach contained chloride of zinc and free hydrochloric acid. The whole of the bowels were hardened and contracted, the mucous membrane thickened and grey in colour—the duodenum and upper part of the jejunum especially so. ('Brit. Med. Journ.,' 1883, ii. p. 820.)

After death from this poison, the lining membrane of the mouth and throat has been found white and opaque—that of the stomach has sometimes been hard and leathery, at others corrugated, opaque, and of a dark leaden colour. The lungs and kidneys are congested. The chloride is both a corrosive and irritant poison, exerting also a peculiar action on the nervous system. If a person survives the acute stage, he may die in the chronic stage from stricture of the gullet or pylorus, or from emaciation and exhaustion as a result of the local action of the poison on this organ.

Analysis.—In these two compounds, the zinc is detected by their aqueous solutions giving white precipitates with a current of sulphuretted hydrogen gas, while the sulphuric acid or the chlorine may be recognized by their respective tests. Metallic zinc may be obtained by plunging into a weak solution of the salt, a slip of magnesium.

PREPARATIONS OF IRON.

Ferrous Sulphate. Sulphate of Iron. Copperas. Green Vitriol.—This compound has been administered with malicious intention. One death from it took place in 1837 or 1838. It cannot, however, be an active preparation; for a girl who swallowed an ounce of it recovered, although she suffered for some hours from violent pain, vomiting, and purging. (Christison on Poisons.) Green vitriol, or copperas, is sometimes given as an abortive. A woman of the name of *Riley* was indicted (Nottingham Aut. Ass., 1859) for administering copperas to two children. She put the substance into gruel. It gave to the gruel a greenish colour and a peculiar taste, which led to the discovery. It caused sickness, but no other serious symptoms. As there was no evidence of an intent to murder, and it was then not unlawful to administer poison with any other intent, the prisoner was acquitted. This salt has been much used for criminal purposes in France. (See 'Med. Gaz.,' vol. 47, p. 307; also 'Ann. d'Hyg.,' 1850, vol. 1, pp. 180, 416; and 1851, vol. 1, p. 155; vol. 2, p. 337.)

Ferric Chloride. Muriate of Iron. Perchloride of Iron.—This is usually met with as an acid solution in water or in rectified spirit. These solutions are of a red-brown colour, and are much employed as medicine. They are sometimes made with wood-spirit or methylated spirit, which gives to them a peculiar odour. Christison relates an instance in which a man, by mistake, swallowed an ounce and a half of such a liquid. The symptoms were somewhat like those produced by hydrochloric acid. He at first rallied, but died in about five weeks. The stomach was found partially inflamed, and thickened towards the intestinal end.

Comparatively small doses of these solutions may seriously affect pregnant women; and among the criminal uses to which they have been put may be mentioned that of procuring abortion. A druggist was convicted (Lincoln Lent Assizes, 1863, *Reg.* v. *Rumble*) of having supplied the perchloride to a woman with the intent to procure her miscarriage. The health of the woman was greatly injured by the administration of the liquid. The editor has met with several instances of the administration of ferric chloride to pregnant women with the view of procuring abortion; and for this purpose it is commonly combined with aloes.

PREPARATIONS OF CHROMIUM.

Potassium Bichromate, or Bichromate of Potash.—Well-observed instances of poisoning by this compound, which is now extensively used in the arts, are rare; and therefore the details of the following case ('Med. Gaz.,' vol. 33, p. 734) are of interest. A man, æt. 64, was found dead in his bed twelve hours after he had gone to rest: he had been heard to snore loudly, but this had occasioned no alarm to his relatives. When discovered, he was lying on his left side, his lower limbs being a little drawn up to his body: his countenance was pale, placid, and composed; the eyes and mouth were closed and the pupils dilated; there was no discharge from any of the outlets of the body; and there were no marks of vomiting or purging, nor any stain upon his hands or person, nor upon the bed-linen or furniture. The surface was moderately warm. Some dye-stuff, in the form of a black powder, was found in his pocket. On inspection, the brain and its membranes were healthy and natural; there was neither congestion nor effusion in any part. The thoracic viscera were healthy, as well as those of the abdomen, with the exception of the liver, which contained several hydatids. A pint of turbid, inky-looking fluid was found in the stomach. The mucous membrane was red and vascular, particularly at the union of the greater end with the gullet: this was ascribed to the known intemperate habits of the deceased. In the absence of any obvious cause for death, poison was suspected; and on analyzing the contents of the stomach they were found to contain bichromate of potash. The dye-powder taken from the man's pocket consisted of this salt mixed with cream of tartar and sand. It is remarkable that in this case there was neither vomiting nor purging. The salt does not appear to have acted so much by its irritant properties, as by its effects on the nervous system. This, however, is by no means an unusual occurrence, even with irritants far more powerful than the bichromate of potash. A boy recovered from the effects of a dose of this salt, but only after the lapse of four months. The first symptoms were pain, vomiting, dilated and fixed pupils, cramps in the legs, and insensibility. His recovery was due to early and active treatment. ('Guy's Hosp. Rep.,' 1850, p. 216.) Another case in which, owing to timely treatment, a man, æt. 37, recovered from a large dose of the salt, was communicated to the author. It seems that with suicidal intent the man swallowed about two ounces of the bichromate in solution, mixed with pearl-ash. In about two hours he was seen by Andrews, and he was then apparently in a dying state. He was suffering chiefly from severe cramps, the pupils were dilated, the pulse was scarcely perceptible, and there was vomiting and purging of greenish-coloured evacuations. The stomach-pump was used, and olive-oil and diluents were given. In about nine hours the urgent symptoms abated, and the man complained only of great pain in the shoulders and legs. There was no gastric irritation nor tenderness of the abdomen. He was discharged, cured, at the end of a week. A woman, æt. 24, died from the effects of this poison taken for the purpose of procuring abortion. The symptoms were those of an irritant—severe pain, vomiting, and purging. (Horn's 'Vierteljahrsschr.,' 1866, 2, 113.)

This salt, in a state of fine powder, or in a saturated solution, has a local irritant action on the skin and on parts from which the skin has been removed. ('Ann. d'Hyg.,' 1864, 1, 83.) It produces what are called 'chronic sores,' affecting the hands and exposed parts of the face. According to recent observations, workers in chrome factories—of which there are only six in the world—suffer from a peculiar irritation of the septum of the nose, apparently due to the action of bichromate of potash, which leads to a perforation of the nasal septum. ('Lancet,' 1882, i. p. 169.) Chromic acid is a powerful corrosive poison, destroying all organic textures. ('Pharm. Jour.,' Jan. 1872, p. 568.)

Chromate of Lead (Chrome Yellow) is a powerful irritant poison. A dose of a few grains of this pigment has proved fatal. (See case of two boys. 'N. Syd. Soc. Bien. Retrospect,' 1873–4, p. 452.)

Analysis.—The bichromate may be recognized by its orange-red colour, as well as by the intense yellow colour which it gives to water when dissolved. Its solution gives a deep red precipitate with silver nitrate, a pale yellow with barium nitrate, and a bright yellow with a salt of lead.

These are the principal metallic irritants; but the compounds of tin, silver, gold, chromium, bismuth, have also an irritant action. Cases of poisoning by these substances are, however, rare. (See 'On Poisons,' 3rd edit. 1875.)

VEGETABLE AND OTHER IRRITANTS.

CHAPTER 15.

VEGETABLE IRRITANTS.—ALOES.—GELSEMIUM.—SAVIN.—CROTON-OIL.—CASTOR-OIL.—COLCHICUM.—HELLEBORE.—VERATRINE.—CARBOLIC ACID.—RESORCIN.—PETROLEUM.—ANIMAL IRRITANTS: CANTHARIDES.—NOXIOUS ANIMAL FOOD.—FISH.—MUSSELS.—CHEESE.—SAUSAGE POISON.—PORK.—TRICHINOSIS.—POISONED GAME.—PTOMAÏNES.

General Remarks.—The poisonous substances of an irritant nature which belong to the vegetable kingdom are very numerous as a class; but it will here be necessary to notice only those which have either caused death, or have given rise to accidental poisoning.

Aloes. Colocynth. Gamboge. Jalap. Scammony.—These different substances, which are used in small doses as medicines, are liable, when taken frequently or in large quantities, to excite severe vomiting, purging, and other symptoms of irritation. In one case a dose of colocynth (three pennyworth) proved fatal to a woman, æt. 22. She was pregnant, and had taken the drug for procuring abortion, for which purpose it is often used. It operated as a violent irritant. ('Phar. Jour.,' June 22, 1878, p. 1035.) Christison recorded the death of a young woman from a teaspoonful and a half of the powdered pulp. Roques states that less than sixty grains of the powder, in decoction, has proved fatal; whilst recovery has taken place after three times that amount. (Husemann, 'Handb. d. Toxicol.,' p. 625.)

Hierapicra (*Holy Bitter*) was formerly a popular aloetic compound, and one death is recorded to have been produced by it in 1837–8. There is reason to believe that it is occasionally used for the purpose of procuring criminal abortion. A man was tried and convicted of this offence (*Reg.* v. *White*, Aylesbury Lent Ass., 1857), and the noxious properties of this compound then became a subject of legal inquiry. The dose, and the condition of the woman to whom it is administered, will of course affect the answer to this question. At the trial above mentioned, it was properly considered to be a noxious substance within the meaning of the statute. The fact that, under the name of *Pulvis Aloes cum Canellâ*, it was formerly admitted into the British Pharmacopæia, cannot justify the mischievous uses to which it may be put. *Hierapicra* is a snuff-coloured powder, of an intensely bitter taste. It consists of four parts by weight of aloes, and one part by weight of powdered Canella bark. The proper medicinal dose was formerly fixed at from five to fifteen grains. Its injurious effects on pregnant women are chiefly due to the aloes. This drug specially affects the rectum, and by contiguity, under violent irritation or purging, may affect the uterus. From the taste and colour which it imparts to liquids, it is not probable that it could be taken by a woman unknowingly.

YELLOW JASMINE (GELSEMIUM NITIDUM *seu* SEMPERVIRENS).

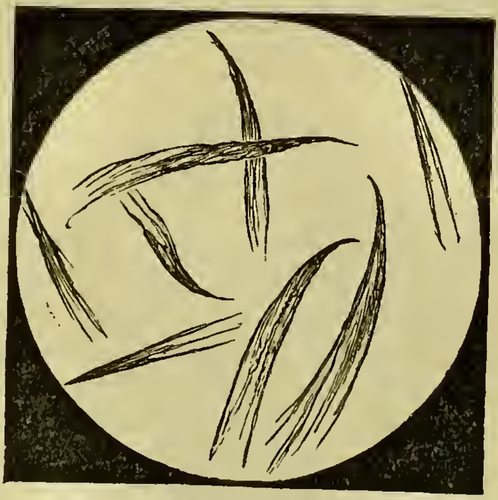
An alcoholic extract of the root of this plant, and a tincture, are used for medicinal purposes.

It has acted as a poison and destroyed life, but its exact place as a poison cannot yet be satisfactorily assigned. From a case reported by Wormley ('Amer. Jour. of Pharm.,' Jan. 1870), it appears to belong rather to the irritant than the narcotic class of substances.

A young healthy married woman took by mistake three teaspoonfuls of fluid extract of gelsemium—a concentrated tincture of the root containing 480 grains to the fluid ounce. She was several weeks advanced in pregnancy. In two hours after taking the extract she complained of pain in the stomach, nausea, and dimness of vision. These *symptoms* were followed by great restlessness, ineffectual efforts to vomit, and general perspiration. In four hours the pulse was feeble, irregular, and intermittent. There was great prostration, with irregular and slow breathing. The skin was dry, the limbs cold, the pupils dilated and insensible to light; the eyes were fixed, and there was inability to raise the eyelids. The vital powers rapidly gave way, and, without convulsions, death occurred in seven hours and a half after the poison had been taken. On *inspection*, the membranes and substances of the brain and spinal marrow were normal. The adipose tissue was tinged with bilious-looking matter. The lungs were collapsed, but natural in appearance, and the superficial veins were congested. The heart was normal—the superficial veins were injected, and the cavities were distended with dark grumous blood, inside of which was a well-defined fibrinous deposit. The stomach contained a small quantity of ingesta; the peritoneum and intestines were in a healthy state. The left kidney was congested. It will be seen from this account that, while death took place rapidly, there was nothing characteristic in the symptoms and appearances. A muscular man, twenty-eight years of age, after a drinking bout, took about two fluid ounces of fluid extract of gelsemium, to 'quiet his nerves.' When seen, his face was flushed; he was dozing, but could easily be roused, and talked intelligently; the pupils were moderately dilated, reacting to light, and there was slight drooping of both eyelids. The pulse was strong and full, and about 100 per minute. An hour later, the dipsomaniac eluded his watchers, managed to get out to a drug-store, and procured half an ounce of fluid extract of gelsemium, which he drank. He was found twenty-five minutes later, sitting in a shop, with relaxed limbs and pale face; and he was capable of speech. As he refused to swallow an emetic, sulphate of zinc was administered through the nose. Copious vomiting followed this and a second dose that was given. In spite of this, he became speedily unconscious; pulse 130; respiration 40, and entirely thoracic; pupils moderately dilated, but acting. Brandy was given subcutaneously and by the rectum, and, after faradization of the diaphragm and intercostal muscles, he rallied from the state of collapse into which he had fallen, only to relapse shortly after, when the same measures were repeated, and also hypodermic injections, first of atropine, then of carbonate of ammonium and inhalation of nitrite of amyl, were employed. He died about five hours after taking the poison. ('Boston Med. and Surg. Jour.,' Dec. 22, 1881.)

Savin (*Juniperus Sabina*).—This is a well-known plant, the leaves of which exert an irritant action both in the state of infusion and powder of a remarkable odour. They yield by distillation a light yellow acrid volatile oil, on which the irritant properties of the plant depend. The powder is sometimes used in medicine, in a dose of from five to twenty grains. Savin is not often taken as a poison for the specific purpose of destroying life; but this is occasionally an indirect result of its use as a popular means of procuring abortion. From the little that is known of its effects, it acts by producing violent pain in the abdomen, vomiting, and strangury. After death, the gullet, stomach, and intestines, with the kidneys, have been found either much inflamed or congested. It has no specific action as an abortive, but operates, like other irritants, by causing a violent shock to the system, under which the womb may expel its contents. Such a result can never be obtained without placing in jeopardy the life of a woman; and thus, when abortion follows, she generally falls a victim. Oil of savin given with sulphate of iron and aloes, in the form of pills, is used by criminal abortionists after instrumental interference, during the earlier months of pregnancy. (*Reg.* v. *Phillips*, C. C. C., Feb. 1885.)

Fig. 17.



Tips of the leaves of Savin, magnified 30 diameters.

The presence of savin in powder in the stomach and bowels may be recognized by the peculiar odour, and by the presence of microscopic fragments (see Fig. 17, p. 147) of the plant. The woody tissue of the plant has the characteristic dots of coniferous woody tissue. Yew has a similar structure, but is destitute of the true savin odour. Yew and savin are the only poisonous coniferæ of this country. Yew berries are highly poisonous; but the luscious pulp forming the exterior of the so-called berry is innocent.

Croton-Oil.—This is an oil extracted from the seeds of the *Croton tiglium.* It is a powerful drastic purgative, producing, in a large dose, severe purging, collapse, and death. A case occurred in Paris, in 1839, in which a man swallowed by mistake two drachms and a half of croton-oil. In three-quarters of an hour the surface was cold and clammy, the pulse imperceptible, the breathing difficult, and the extremities and face were as blue as in the collapsed stage of cholera. In an hour and a half purging set in; the stools were passed involuntarily, and the abdomen was very sensitive to the touch. The patient complained of a burning pain in the course of the gullet. He died in four hours after swallowing the poison. There was no marked change in the mucous membrane of the stomach. (For another fatal case, see 'Pharm. Jour.,' Feb. 1863, p. 379.)

Castor-Oil.—The seeds of the castor-oil plant are occasionally fatally poisonous to children, who are attracted by their beautifully mottled appearance. They act as a powerful drastic. Three seeds have destroyed the life of an adult. ('Med. Times and Gaz.,' 1861, i. p. 555. See also 'Ann. de Thérap.,' 1872, p. 103; and 'Ann. d'Hyg.,' 1871, i. p. 400.)

Meadow-Saffron (*Colchicum*).—Meadow-saffron (COLCHICUM AUTUMNALE) contains a poisonous alkaloid—*colchicine.* The most noxious parts of the plant are the bulbs (or roots) and seeds, but the leaves and flowers have also an irritant action.

Symptoms and Appearances.—The symptoms in cases of poisoning by colchicum are generally well marked. There is burning pain in the throat and stomach, intense thirst, violent vomiting and purging, leading rapidly to exhaustion, coldness and clamminess of the skin, excessive depression, and great weakness. The pulse is small, weak, and fluttering; and death appears to take place from complete exhaustion, without convulsions or loss of consciousness. Among four cases (*infra*) presenting these symptoms, one person died on the second, one on the fifth, one on the eighth, and one on the fourteenth day. In another case of poisoning by wine of colchicum, the symptoms did not come on for an hour and a half; there was then copious vomiting of a yellow fluid, severe pain with great tenderness in the abdomen, tenesmus, and thirst. The patient died in forty-eight hours, without being convulsed or manifesting any sign of cerebral disturbance. A woman, who took an ounce and a quarter of the wine, recovered in about twenty-four hours. She suffered chiefly from severe griping pains. The pupils were contracted, and the heart's action was very feeble. The after-symptoms were headache and nausea. ('Lancet,' 1877, ii. p. 263.) The chief morbid appearance was a patch of redness on the mucous membrane of the stomach, near the cardiac orifice; the intestines were slightly inflamed. The head was not examined. ('Med. Gaz.,' vol. 10, p. 161; see also Casper, 'Gerichtl. Med.') In a case of poisoning by the medicinal administration of colchicum, three drachms and a half of the wine of colchicum were taken in divided doses, and caused death on the fourth day. There was no inflammation of the mucous membrane, but simply extravasation of blood into the mucous follicles. The mucous membrane has been found softened in two cases of poisoning by the tincture. In two other cases, in which an ounce and a half of the tincture was taken, and death ensued in forty-eight hours, no morbid appearances were found. (Casper, 'Gerichtl. Med.;' and see 'Vierteljahrsschr. f. Gerichtl. Med.,' 1860, vol. 1, p. 1.)

Colchicum has acquired an evil notoriety as a poison. A woman (*Reg.* v. *Catherine Wilson*, C. C. C., Sept. 1862), after having been tried and acquitted for an attempt to poison, with oil of vitriol, the wife of a man with whom she cohabited, was in the following September convicted of the murder of a *Mrs. Soames*, who had died suddenly while nursed by the prisoner six years previously. The body was exhumed, but no poison was found in the remains; yet the medical and other circumstances, as well as the conduct and correspondence of the prisoner, proved to the satisfaction of the Court that deceased had been destroyed by vegetable poison, most probably colchicum, with the noxious properties of which she was proved to have been well acquainted. From the facts which transpired in reference to this trial, it appeared that the deceased was one of four persons who had at different dates fallen victims to the acts of this woman. 1. *Peter Mawer*, a master mariner of Boston, died in October, 1854: the body was exhumed in 1862, but no poison was detected. 2. *Mrs. Jackson*, of Boston, who died in December, 1859: the body was exhumed in January, 1860, and no poison detected. 3. *Mrs. Atkinson*, of Kirkby Lonsdale, who died in October, 1860: the body was exhumed in May, 1862, and no poison detected. 4. The case of *Mrs. Soames*, above mentioned. All these persons died suddenly while in a state of health, under similar symptoms, and without any apparent natural cause to account for death. The symptoms as a whole were not reconcilable with any known disease; and they only appeared after the prisoner was proved to have administered, under some pretence or other, food or medicine, the bottle which she employed for this purpose being kept locked up or in her own possession. The motive for the murder in each case was the acquisition of money or property of which the prisoner came into possession—in Peter Mawer's case by a will made shortly before his death, and in Mrs. Atkinson's case by an act of robbery after her death. Two other attempts at murder, which failed, led to the inference that colchicum was the substance which this woman employed, either in wine or brandy. In these four persons the symptoms were as nearly as possible of the same character—burning pain in the throat and stomach, intense thirst, violent vomiting and purging, coldness and clamminess of the skin, excessive depression, and great weakness. The pulse was small and weak, and death appeared to take place from complete exhaustion, without convulsions or loss of consciousness. In most of the cases the poison was probably given in divided doses; in the last case, the symptoms appeared regularly every evening after the deceased had taken the tea prepared by the prisoner. [Grave doubts have, however, been entertained by experts as to the kind of poison administered: the author's opinion as to its being colchicum is not universally shared by toxicologists.—Editor.]

Colchicine.—The noxious properties of colchicum are owing to the presence of this alkaloid. It may be separated from liquids containing it by a process similar to that described for strychnine. It is, however, but little known.

Hellebore.—Symptoms and Appearances.—According to Wibmer, the roots of the black hellebore (*Helleborus niger*) possess the greatest activity; but the leaves are also highly poisonous when used in the form of infusion. By long boiling the poisonous properties of the plant are diminished, probably owing to the loss of the volatile principle. The roots and leaves have a local irritant action, producing in small doses violent vomiting and purging, with severe pain in the abdomen, followed by cold sweats, convulsions, insensibility, and death. The powdered root, in a dose of a few grains, acts like a drastic purgative. In a case reported by Morgagni, half a drachm of the aqueous extract killed a man, æt. 50, in eight hours. The symptoms were severe pain in the abdomen and violent vomiting. After death the whole of the alimentary canal was found inflamed, but especially the large intestines. A case is quoted by the same writer, in which a table-spoonful of the finely powdered root (taken by mistake for rhubarb) caused severe symptoms of irritant poisoning, which did not disappear for four hours. The man recovered on the fourth day. The experiments performed by Orfila on animals show that this poison acts like a local irritant when applied to a wound. Hellebore is a favourite remedy for worms among quacks. It is not, therefore, surprising that it should be occasionally administered in an overdose, and cause death. Edwards met with a case in which a gentleman had swallowed experimentally one drachm of tincture of green hellebore (*Veratrum viride*), equal to twelve grains of the powder. He was found soon afterwards in a collapsed state; features sunk, skin cold, and covered with a profuse clammy sweat; pulse scarcely perceptible. He complained of intense pain in the region of the stomach. There was no purging. These symptoms were relieved by treatment, and the next morning the patient had recovered. ('Med. Times and Gaz.,' 1863, 1, p. 5.)

Veratrine.—White hellebore (*Veratrum album*) owes its noxious properties to the alkaloid *veratrine* or *veratria*, which is itself a powerful poison. The alkaloid is prepared from the cevadilla seeds. Callaway communicated to the author the following case: A physician prescribed medicinally, for a lady, one grain of veratrine divided into fifty pills, and three were directed to be taken for a dose. Not long after the dose had been swallowed, the patient was found insensible, the surface cold, the pulse failing, and there was every symptom of approaching dissolution. She remained some hours in a doubtful condition, but ultimately recovered. Supposing the medicine to have been well mixed, and the pills equally divided, not more than one-sixteenth of a grain of veratrine was here taken. The common veratrine of the shops is sometimes given medicinally, in doses of one-sixth of a grain. Poisoning by veratrine is a rare occurrence. We have not met with an instance in which this alkaloid has been indubitably administered with criminal intention. Judging from its effects on animals, it would cause vomiting and convulsions, with insensibility.

Analysis.—In the state in which it is usually seen, it is a whitish powder, scarcely soluble in boiling water, but dissolved by alcohol, ether, and benzene. Acids readily dissolve it, forming salts which on evaporation do not yield crystals. The powder has a hot, acrid taste, and if any portion enters the nostrils, it causes most violent sneezing, lasting for some time. Strong nitric acid gives to the powder a light-red colour, becoming ochreous after a time. Hydrochloric acid, strong or diluted, with the aid of heat, produces a beautiful red tint. The best test for its presence is diluted sulphuric acid, which, by a gentle heat, strikes a rich pink colour, which is destroyed by a solution of chlorine, but not by stannous chloride. Strong sulphuric acid turns the powder yellow, but on heating the mixture, the colour deepens, and finally becomes a deep red; when the liquid is diluted, it passes to a dingy yellow. Veratrine undergoes no change when mixed with iodic acid, but it gives immediately, with sulphomolybdic acid, a deep greenish yellow colour passing to a brown red.

Veratrine is insoluble in water. It may be brought into solution in organic liquids by warming with acetic acid. The liquid is treated with potash and then shaken with two parts of benzene. The alkaloid, if present, is obtained by decanting and evaporating the benzene solution. The tests may then be applied to it. It has not yet been detected in the tissues. The editor had a case referred to him in which a woman died about twenty minutes after taking some gruel. A medical man thought that he detected veratrine in the viscera and in the gruel. The editor, however, detected strychnine in these articles; and the *post-mortem* appearances were those of strychnine. A case occurred in 1865, in which death was attributed to the action of veratrine criminally administered. The deceased, a woman, was advanced in pregnancy, and from the medical evidence she died from puerperal convulsions and Bright's disease of the kidney, with effusion of blood on the brain. It was said that veratrine was detected in her body and in the urine, but there were no symptoms of poisoning by veratrine, and there was no evidence of administration by any one. The chemical analysis was not published, or it might have appeared that too great a reliance had been placed upon the tests employed. ('Med. Times and Gaz.,' 1865, i. p. 472.) It was probably a case of death from natural causes mistaken for poisoning.

CARBOLIC ACID.

Carbolic Acid, Phenic Acid, or *Phenol*, is a crystalline product of the distillation of coal-tar. When pure it melts at 102° F. It has a characteristic and not unpleasant odour. When a small proportion of water is added to the crystals, they liquefy. It is moderately soluble in water. The commercial crystals have an unpleasant odour, which is due to impurities; and they acquire a red colour on exposure to light. More commonly carbolic acid is met with as either a colourless or more or less brown liquid, of nauseous odour, containing about 80 per cent. of phenol; or as a dark brown liquid chiefly consisting of heavy oil of tar, with about 30 per cent. of the acid. These are largely used as disinfectants. Applied to the skin or to a mucous membrane, it coagulates the albuminous constituents, causes a severe burning pain and a white eschar. A death is stated to have occurred from the external use of the acid ('Brit. Med. Jour.,' 1870, ii. p. 382); and its use as an antiseptic lotion has repeatedly produced serious, if not fatal, results. Deaths from the internal use of carbolic acid—usually accidental, but not infrequently suicidal—are now common. In 1880 sixteen deaths were registered in England and Wales from this cause. Carbolic acid, so called, does not redden litmus.

Symptoms and Appearances.—When the poison is swallowed in solution, or in the form of undiluted liquid, the patient experiences a hot burning sensation, extending from the mouth to the stomach. This feeling is experienced during the act of swallowing; and the lining membrane of the mouth is whitened and hardened. Carbolic acid is rapidly absorbed, and in the course of a few minutes the system may be profoundly affected. In two instances the rapidity of action was comparable to that of prussic acid. Although the local application of the acid to a part is commonly followed by severe burning pain, this may be entirely absent in cases of poisoning by this agent, and even a local diminution of sensibility may be produced. Nervous symptoms are those most strikingly manifested, such as delirium, giddiness, and profound insensibility. Nausea and vomiting were present in not more than one-fifth of the observed cases. These symptoms may, however, be severe and uncontrollable. There is extreme feebleness of the pulse, and dry harsh skin, with lividity of the surface. The urine, as was first pointed out by the editor ('Guy's Hosp. Rep.,' 1868, p. 407), is often of an olive-green or even black hue; but this appearance is more common in sub-acute than in acute and rapidly fatal cases. The pupils are generally minutely contracted. Convulsions and trismus are not infrequently observed. A case of carbolic acid-poisoning can rarely fail to be recognized. The whitening of the mouth, the brown eschars which form on the skin at its angles where the poison trickles from the mouth, the odour of the breath, and the profound insensibility and stertorious breathing, with minutely contracted pupils, rarely leave any doubt as to the nature of the case. The editor has, nevertheless, met with a case in which a rather pure form of the acid having been taken for suicidal purposes, the odour of carbolic acid escaped notice.

Period of Death.—Death has several times occurred within twenty minutes of the administration of the poison; and it usually supervenes within four hours. Occasionally, in fatal cases, life may be prolonged for twenty-four and even forty-eight hours.

Fatal Dose.—This is unknown. There is reason to believe that, if absorbed, a few grains of the poison might prove fatal, and six or seven drops have produced serious results. Two fluid drachms of the liquid acid have killed a child, two years of age, in twelve hours. ('Guy's Hosp. Rep.,' 1867, p. 233.) In one case a child, six months old, was killed by the administration of a quarter of a teaspoonful of the acid dissolved in glycerine—one part of acid to five of glycerine. ('Brit. Med. Jour.,' 1882, i. p. 748.) Recovery has, however, taken place after large doses have been taken. A girl, æt. 14, swallowed six fluid drachms of the undiluted (30 per cent.) acid. In twenty minutes she was comatose and breathing stertoriously; her face was livid, the pulse was small and irregular; the pupils contracted, but not so much as in opium-poisoning. The stomach was washed out with soap and water, and then with milk and water. In an hour the lividity diminished, and consciousness slowly returned. She did not complain of any gastric irritation. ('Brit. Med. Jour.,' 1882, i. p. 939.) A robust woman, æt. 30, swallowed nearly half an ounce of an alcoholic solution of carbolic acid, containing 35·8 per cent. of the poison. It was ascertained that, by the use of the stomach-pump, rather more than half of the poison was removed from the stomach, but that at least 92 grains of the poison were left for absorption. The most prominent symptoms were insensibility within ten minutes, and dizziness speedily passing into profound coma, irregular breathing and pulse, contracted pupils, extreme blueness (cyanosis) of the surface of the body, depression of the body temperature to 94° F., and hæmoglobinuria, *i.e.* the presence of unaltered blood-pigment in the urine, which contained no red blood-corpuscles. This last condition set in one hour after the poison was taken, and lasted for seven hours and a half. The urine reacted for carbolic acid during two days. The woman recovered. ('Berlin Klin. Wochenschr.,' 1881, No. 48.)

Analysis.—Carbolic acid gives a purple colour when a drop of solution of ferric chloride is added. When in solution, it yields a copious precipitate of tribromophenol when an excess of bromine-water is added. This precipitate, when washed on a filter and treated with sodium amalgam, again yields phenol (carbolic acid).

To detect carbolic acid in viscera, vomit, urine, etc., acidulate the suspected material with sulphuric acid, and distil, using suitable condensing arrangement. The distillate may have the odour of phenol. It is precipitated with an excess of bromine-water; the precipitate is washed with water on a filter, and, whilst still moist, treated with sodium amalgam in water. After a time, on acidifying the solution, the peculiar odour of carbolic acid will be perceived. By shaking the mixture with ether, pipetting off the ether, and evaporating it in watch-glasses, oily streaks of phenol will be left; these may be tested with ferric chloride as described above.

RESORCIN.

Resorcin is an antiseptic, recently introduced into medicine. It is a phenol, *i.e.* a body closely allied to carbolic acid, crystallizing in colourless crystals, which are readily soluble in water, ether, or alcohol. Applied in the form of crystals, it acts as a powerful caustic to the skin. The commercial resorcin, which is obtained as a by-product in the manufacture of a pigment known as eosine, has a red colour, and a powerful odour resembling that of carbolic acid. It is used internally as a medicine. On one occasion, in which an overdose of two drachms was given to a young woman, it produced decided toxic symptoms—insensibility, profuse perspiration, blanched lips, equal normal pupils, lowness of body temperature, imperceptible pulse, and almost imperceptible breathing. The urine was olive-green in colour. The patient recovered. ('Med. Times and Gaz.,' 1881, ii. p. 487.) It thus appears that resorcin acts like carbolic acid on the human organism.

PETROLEUM.

Under the term petroleum, or rock-oil, are included various oils used for illuminating purposes, of peculiar odour, which spring from the ground in various parts of the globe; and consist of mixtures of various inflammable hydro-carbons. The illuminants which were in use prior to the introduction of American petroleum possess analogous composition, as paraffin-oil, solar-oil, photogene, etc. Cases of petroleum-poisoning are rare, considering the frequent use of this well-known substance.˙. The majority of cases arise from drinking out of bottles supposed to contain spirituous liquors, although there have occurred a few cases of intentional poisoning by this liquid; for instance, a case at Brescia ('Jour. de Chim. Méd.,' Nov. 1866, p. 597); and another in the province of Posen, particulars of which are wanting. In general the poisonous properties of petroleum, such as the purified American variety, cannot be rated very high; but many varieties of crude petroleum, on account of their containing sulphur compounds, are much more poisonous, according to Bulenberg, as, for instance, crude petroleum from Canada. In adults a wine-glassful may not kill, and in one case, that of *Mayer*, in Antwerp, five fluid ounces did not cause death. According to Köhler ('Physiol. Thér.,' p. 347), half a wine-bottleful is not a fatal dose for an adult. Even in the case of children, among whom the editor has seen several cases, the fatal dose is a very large one; and in the event of death supervening, it is due rather to the secondary result of local action of the poison on the stomach and intestines than to the result of the absorption of hydro-carbons.

In cases of poisoning, generally after vomiting follow giddiness, a sense of fulness of the head, with pain and feeling of constriction; and in children, collapse, somnolence, pallor of the face, coldness of the skin, cold sweats, and weak pulse may supervene. Neither the behaviour of the pulse, nor of the pupils, is constant. In collapse, the latter are dilated; and in an excited condition they appear contracted. For the diagnosis, the odour of petroleum in the breath is generally a safe guide. Eructations and vomiting also betray the presence of petroleum. Finally, the urine may acquire a peculiar odour, which may last for several days. In *Mayer's* case this odour resembled that odour of violets which the urine acquires after the ingestion of oil of turpentine and other essential oils.

Analysis.—The detection of petroleum, either in the vomited matters or in the contents of the stomach, is effected by distilling the suspected matters, and determining the chemical and physical properties of the distillate.

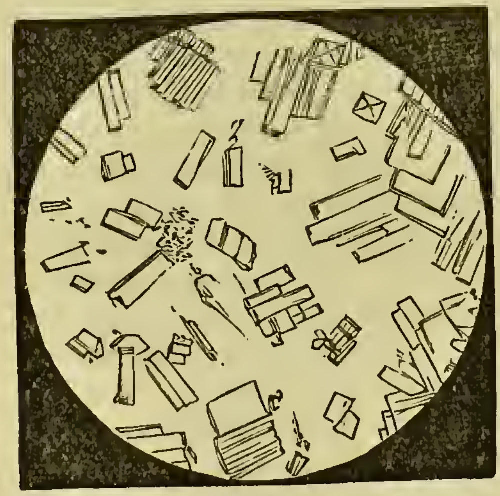
ANIMAL IRRITANTS.

CANTHARIDES. (SPANISH FLIES.)—*Symptoms.*—When cantharides are taken in *powder*, in a dose of one or two drachms, they give rise to the following symptoms: a burning sensation in the throat, great difficulty of swallowing, violent pain in the abdomen, with nausea and vomiting of a bloody mucus; there is also great thirst, with dryness of the fauces. As the case proceeds, a heavy dull pain is commonly experienced in the loins, and there is an incessant desire to void urine; but only a small quantity of blood, or bloody urine, is passed at each effort. The abdominal pain becomes of a violent griping kind. Purging supervenes, but this is not always observed; the matters discharged from the bowels are mixed with blood and mucus, and there is often tenesmus (straining). In these, as well as in the vomited liquors, shining green or copper-coloured particles may be commonly seen on examination, whereby the nature of the poison taken, if it has been taken in powder, will be at once indicated. After a time, there is priapism, and the genital organs are swollen and inflamed both in the male and female. When the case proves fatal, death is usually preceded by faintness, giddiness, and convulsions. The *tincture* of cantharides produces similar symptoms: they are, however, more speedily induced, and the burning sensation in the stomach and constriction of the throat are more strongly marked; this symptom is often so severe as to render it impossible for the person to swallow; and the act of swallowing gives rise to excruciating pain in the throat and abdomen. (For the symptoms and appearances in a case in which three ounces of the tincture proved fatal, see 'Brit. Med. Jour.,' 1876, i. p. 191.)

Appearances.—In one well-marked case, the whole of the alimentary canal, from the mouth downwards, was in a state of inflammation. The mouth and tongue seemed to be deprived of their mucous membrane. The ureters, kidneys, and internal organs of generation were also inflamed. In another instance, in which an ounce of the tincture was swallowed, and death did not occur for fourteen days, the mucous membrane of the stomach was not inflamed; but it was pulpy, and easily detached. The kidneys were, however, inflamed. The brain has been found congested, and ulceration of the bladder is said to have been met with. There are few fatal cases reported in which the appearances have been accurately noted; indeed, the greater number of those who have taken this poison have recovered.

The quantity required to produce serious symptoms, or to destroy life, has been a frequent subject of medico-legal inquiry. The medicinal dose of the tincture is from five to ten minims, but may be gradually increased to one fluid drachm; of the powder from a quarter up to *two grains*. Doses above these, whether of the powder or the tincture, are likely to be injurious, and to give rise to symptoms of poisoning. The *smallest quantity* of the powder which has been hitherto known to destroy life, was in the case of a young woman, quoted by Orfila; the quantity taken was estimated at *twenty-four grains* in two doses. She died in four days; but as abortion preceded death, this may have been concerned in accelerating that event. An *ounce* of the tincture taken by a boy, æt. 17, caused death in fourteen days. This is the smallest recorded dose of the tincture which has proved fatal. It must not be inferred from this statement that a smaller quantity of the powder or tincture will not destroy life. The actual dose of either required to prove fatal is unknown. Many more observations are required to determine this point. In *Reg.* v. *Hennah* (Cornwall Lent Ass., 1877), it was wrongly inferred that it would require at least twenty-four grains of the powder to destroy life. There is nothing to prevent half of this quantity from proving fatal; this is purely a matter of experience. It is at present impossible to assign any definite quantity as a minimum fatal dose.

Fig. 18.



Crystals of Cantharidin from a solution in chloroform, magnified 30 diameters.

Chemical Analysis.—For the detection of the powder, the sediment obtained from the suspected liquids should be mixed with alcohol spread on sheets of glass, and allowed to dry spontaneously. The shining scales of the powdered elytra will then be seen, on examining the glass by reflected light, either on one or both surfaces. As the powder is insoluble in water, some portion of it may generally be obtained by washing and decantation. The sediment may then be examined on a glass slide with the microscope. If no portion of the powdered beetles can be procured, the suspected liquids or solids should be evaporated to dryness and the dry residue digested in successive quantities of ether until exhausted. This will dissolve the cantharidin, the active principle, which forms only the 1–250th part of the elytra of the beetle. The ethereal solutions are evaporated to an extract, and some of this extract, spread on oil-silk, may be applied to a thin portion of the skin of the arm or to the lips. The production of a blister, with serum, under these circumstances, is considered to indicate the presence of cantharidin. By this method Barruel discovered cantharides in chocolate. ('Ann. d'Hyg.,' 1835, i. p. 455.) Chloroform is even a more powerful solvent of cantharidin than ether, and may be used in preference (Fig. 18, p. 156.) As the extract contains frequently a green oil and fat, which prevent cantharidin from crystallizing, it has been recommended to employ disulphide of carbon in order to separate these impurities, the cantharidin not being soluble in the sulphide, while the fat is removed.

Noxious Animal Food.

Certain kinds of animal food are found to produce, occasionally, symptoms resembling those of irritant poisoning. In some instances this poisonous effect appears to be due to idiosyncrasy; for only one person out of several partaking of the food may be affected. These cases are of importance to the medical jurist, since they may give rise to unfounded charges of criminal poisoning. In the absence of any demonstrable poison, we must test the question of idiosyncrasy by observing whether more than one person is affected, and whether the same kind of food, given to animals, produces symptoms of poisoning. If, with this latter condition, several persons are affected simultaneously with similar symptoms, we cannot refer the effects to idiosyncrasy; they are most probably due to the presence of an animal poison. Among the articles of food which have caused symptoms of irritant poisoning, may be mentioned certain shell-fish (mussels), bacon, sausages, diseased pork, and animal flesh in a diseased or putrescent state.

The flesh of the most healthy animal is rendered unfit for food when it is putrescent. It is not merely unwholesome, but highly irritant, rapidly causing vomiting, purging, pain, and other symptoms of a severe kind. Fortunately, these symptoms lead at once to the expulsion of the noxious food from the body, and the person then recovers; the young, the old, and the infirm may, however, be so prostrated by excessive vomiting and purging that they may sink from exhaustion. Thorough cooking destroys the noxious effects of such food. Animal matter in a state of partial decay, or in the transition stage of putrefaction, must also be regarded as of a poisonous nature. Much of the cheap butcher's meat sold to the poor is unfit for human food. In 1851 the family of a surgeon near London were all affected with symptoms resembling irritant poisoning, after having partaken of a hare which had been stewed in a clean earthen vessel. On the second day, the wife was seized with vomiting and purging, giddiness, heat in the throat, and general numbness, with inflamed eyes. Other members of the family vomited, and in the course of a few days the symptoms disappeared.

The vomited matter consisted of portions of the hare partially digested, but in a state of putrefaction, so that there was abundant evidence of sulphuretted hydrogen in the liquid. There was no mineral poison, although the symptoms, it will be observed, were rather like those occasioned by arsenic. It had been remarked by the family that a silver spoon, which had been used in serving out this unwholesome food, was turned of a brown colour, no doubt from the chemical action of sulphuretted hydrogen; and this may be taken as a good domestic test of the putrefied condition of such food. Nature generally applies an appropriate remedy, in the fact that the food itself produces copious vomiting and purging. (See 'Brit. Med. Jour.,' 1877, ii. p. 450.) Cases of this kind must be distinguished from those in which *poisoned game* is sold to the public. The game may be quite free from putrefaction, but noxious from the poisoned grain which may have caused death. It was formerly a very common practice to steep grain in a solution of arsenic, previous to sowing, and pheasants, partridges, and other birds may be accidentally destroyed by eating such grain. In some instances grouse and other game are maliciously destroyed by the laying of corn, saturated with arsenic or other poisons, in the localities where the birds abound. There is no precaution which can be taken by the purchasers of game, except by observing whether the birds have or have not been shot.

It is doubtful whether the Sale of Food and Drugs Act (38 & 39 Vict. cap. 62. s. 6) does not meet such cases; but no prosecution has up to this time been instituted under that statute for the sale of poisoned game.

Poisonous Fish. Mussels.—Of all the varieties of shell-fish, none have so frequently given rise to accidents as the common mussel. The symptoms which it produces are uneasiness and sense of weight in the stomach; a sensation of numbness in the extremities; heat, dryness, and constriction in the mouth and throat; thirst, shivering, difficulty of breathing, cramps in the legs, swelling and inflammation of the eyelids, a profuse secretion of tears, and heat and itching of the skin, followed by an eruption resembling nettle-rash. These *symptoms* are sometimes accompanied by colic, vomiting, and purging. They may occur within ten minutes or a quarter of an hour; but their appearance has been delayed for twenty-four hours. There is generally great exhaustion and debility. These symptoms have proceeded from the eating of not more than ten or twelve mussels. Two cases reported by Christison proved fatal; the one in three, the other in about seven hours. In general, however, especially when there is free vomiting, the patients recover. In the inspection of the two fatal cases above mentioned, no appearance was found to account for death. A case in which two mussels produced, in a boy aged 10, alarming symptoms, followed by an eruption resembling scarlatina and nettle-rash, is reported. ('Guy's Hosp. Rep.,' 1850, p. 213.)

Cheese.—The symptoms produced by cheese have been those of irritant poisoning. The nature of the poison is unknown. In some cases the irritant property is due to a putrefied state of the curd, to the production of a rancid irritant oil, or to the formation of alkaloids. Again, it has been supposed that the poison is occasionally derived from certain vegetables on which the cows feed. In 1858 twenty-five persons suffered from vomiting and purging, more or less violent, owing to their having partaken of cheese.

Sausage-Poison.—The symptoms caused by *sausage-poison* partake of a narcotico-irritant character; they are very slow in appearing—sometimes two, three, or four days may elapse before they manifest themselves. This poison is of a formidable kind; its effects have been chiefly observed in Germany. In the 'Medical Gazette' for Nov. 1842, there is an account of the cases of three persons, who had died from the effects of liver-sausages, which had been made from an apparently healthy pig, slaughtered only a week before. The inspection threw no light on the cause of death. The poisonous property was supposed to depend on a *partial* decomposition of the fatty part of the sausages. It is said that when extremely putrefied they are not poisonous. In one case, a few slices of a German sausage, of old manufacture but not putrescent, caused the death of a child, with violent symptoms of irritation of the stomach and bowels. The author examined a portion of the sausage: it contained no poisonous matter which could be detected. The fatty portions were rancid, and the lean portions very dry. There was no doubt, however, that it had been the cause of the symptoms and death of the child. Tripe published a complete account of the effects produced by sausage-poison. ('Brit. and For. Med. Rev.,' Jan. 1863, p. 197.) It appears that in Nov. 1859 sausages made and sold by a pork-butcher at Kingsland were eaten more or less by sixty-six persons, of whom sixty-four were attacked by violent symptoms of irritation in from three and a half to thirty-six hours after the meal. One case only proved fatal, on the seventh day. No symptoms appeared in this man until after the lapse of *six hours*. It seems that he had eaten one of the sausages raw, and three cooked. He was attacked with severe vomiting and purging, followed by shivering; there was pain in the abdomen, violent headache, and great prostration. The pulse was feeble and quick, and there was delirium. These symptoms underwent a remission, but he had a relapse, became comatose, and died on the seventh day. Latterly he chiefly complained of pain in the bowels. On inspection, Letheby found no signs of inflammation, or of the action of an irritant on the stomach. The small intestines were much inflamed at the lower end, and the gall-bladder was distended. The other organs were healthy. The viscera contained no known vegetable or mineral poison. The sausages were made with heifer-beef, pork fat, sage, and pepper. There was no evidence of anything noxious about them, and a chemical analysis yielded nothing of a poisonous nature. There could, however, be no doubt that the sausages had caused the symptoms and death; the food in this case acting as a narcotico-irritant poison. Other persons suffered from burning in the throat and stomach, followed by vomiting and purging; then giddiness or confusion in the head, and in some there was delirium. In the man who died, the delirium was well marked, and the eyes were red. In those persons who recovered, the noxious animal matter was probably early thrown off by vomiting and purging.

Pork. Bacon.—These common articles of food occasionally give rise to symptoms so closely resembling those of irritant poisoning as to be easily mistaken for them. In some cases the effect appears to be due to idiosyncrasy; but in others it can be explained only by supposing the food to have a directly poisonous action. The noxious effects of pork have been particularly shown by the cases published by McDivitt. ('Ed. Med. and Surg. Jour.,' Oct. 1836.) As pork is sometimes salted in leaden vessels, lead may be found in it; but fresh pork has been observed to have a noxious action. In 1864 Kesteven met with a case in which all the members of a family were attacked with symptoms of irritant poisoning after eating a leg of pork. The principal symptoms were nausea, vomiting, griping pains in the abdomen, and purging; but dogs and cats fed upon the meat did not appear to suffer. Other portions of the animal from which the leg was taken were eaten by other families, and no symptoms of poisoning were produced. The author examined the food without discovering any trace of the ordinary poisons. These cases of poisoning by animal food have been examined by Simon and Gamgee. They have traced the injurious effects of pork to a diseased condition of the pig, owing to the animal having been fed on improper food. The term, 'measly pork,' is now very well known to consist in a diseased condition of the flesh of the animal, in which it is filled with a parasite called cysticercus, which is believed to be the larva of the tapeworm. ('Med. Times and Gaz.,' 1870, 1, p. 485.) This parasite undergoes full development when in the shape of food it reaches the human intestines. These parasites may not directly kill a person who eats this noxious food, but they favour the development of fatal disease. In reference to the possible ill effects from consuming, in a well-cooked state, the flesh of animals afflicted with *anthrax*, or carbuncular fever, evidence is still imperfect. An opinion has been expressed that boils, and perhaps other like afflictions, are caused in human beings by the consumption of diseased meat.

A large amount of diseased and unwholesome meat is sold to the public, and of the various kinds of flesh used as food, none is so subject to disease as pork. Some of the changes which it undergoes are of a microscopical character, and are not noticed. For an account of the diseases affecting the flesh of the pig, their mode of production, and the prevention of accidents, see papers by Delpech, in the 'Ann. d'Hyg.,' 1864, vol. 1, pp. 5, 241. The parasites found in the flesh of this and other animals are apt to escape destruction by boiling, roasting, or smoking, and those are liable to suffer most who habitually eat the raw or partly cooked flesh. The flesh of the pig containing cysticerci presents, in the cooked state, the following appearances: when boiled it is paler than sound meat; it appears dryer in patches, and the muscular fibres are more separated than usual. When these are opened, the parasites are seen in the interstices as opaque white spots, of the size of a hemp seed, and presenting much the same aspect as when living. The caudal bladder attached to their bodies disappears when the meat is thoroughly cooked, and the body of the animal then appears isolated in the middle of the muscular tissue. It is friable, and breaks down easily under pressure, with a crackling sound, owing to the presence of calcareous matter. In this state it does not appear to be necessarily productive of injury. ('Ann. d'Hyg.,' 1864, 1, 249.) All the members of a family were seized with vomiting, purging, and syncope, after having eaten a dish of pork. A medical man examined the meat, and found it full of cysticerci. A pork-butcher was accused of having sold bad meat, but it was proved to have been some cheap pork bought of a hawker of provisions. ('Ann. d'Hyg.,' 1864, 1, 246.) If the cysticerci did not cause the symptoms in this case, the meat had undergone some change sufficient to impart to it irritant properties. These parasites occur in all the fleshy parts of the body. They are not commonly found in the fatty portions of man and animals, and are less common in sheep and oxen than in pigs. In two instances, Ballard and Klein were able to trace conclusively that the poisonous effects of hams which had caused illness and death were due to the presence of low organisms, *bacilli.*

Trichinosis.—The fatal malady arising from the introduction of *Trichina spiralis* into the human body has attracted much attention. Keller has published some important facts illustrating the symptoms produced, and the mode in which this parasite causes death. He considers that it is a question well worthy of the attention of medical jurists, whether many cases of death from suspected irritant poisoning, in which no poisonous matter could be detected in the body, may not have been really due to trichina-disease.

The *Trichina* (from θρίξ, a hair) *spiralis*, a flesh-worm, is found chiefly in the course of the fibres of all the striped muscles of the trunk and limbs, most frequently on those of the front of the chest, neck, and abdomen. It has also been found in the muscular fibres of the heart and gullet. The parasites appear in the form of very small, white, ovoid bodies or capsules, perceptible to the eye as white specks in the midst of the muscular fibres, but only distinctly seen by the aid of a magnifying-glass. The trichina, or worm, is coiled up in the centre of each oval capsule, the greater diameter of which is parallel to the muscular fibre with which it is closely incorporated. The trichina is a parasite which passes the greater portion of its existence, in the chrysalis state, in the muscular system of animals, until, by the consumption of this muscle as food, it finds in the stomach and intestines of another warm-blooded animal a favourable medium for its full development into an intestinal worm. According to Virchow and Zenker, the trichina not only frequently presents itself in the human organism, but this organism is more favourable to its development. The period of incubation of the chrysalis in the stomach and bowels of man, or of warm-blooded animals, is from six to eight days; and during this time it there thrives and propagates to an almost incredible extent. Keller states that in three or four days, the females produce a hundred or more young ones, which begin on the sixth day to leave the parent animal; and he estimates that in a few days after the ingestion of half a pound of meat, the stomach and intestinal canal of a person may contain thirty millions of these minute worms. Herbst found the muscles of two dogs which had been fed upon parts of a badger containing worms, to be loaded with these parasites. When once introduced into the stomach and intestines, the worms leave their capsules, become free, and produce young, which emigrate through the walls of the intestines into the muscles: there they become encysted, and are ultimately found appropriating and destroying the muscular substance to a greater or less extent. After a long residence in the muscle, they appear to acquire calcareous cysts. The sudden liberation of a large number of these worms causes irritation and inflammation in the bowels, attended by peculiar symptoms resembling in some respects those of chronic poisoning.

It is worthy of note that trichinæ are more frequently found in pork, and articles of food derived from it, than in any other kind of meat. Measly pork appears to be sometimes of a trichinous character. Further, the vitality of the parasites is not destroyed unless the meat or other substance in which they are located has been subjected to the temperature of boiling water, for a sufficient time to ensure that every particle has been exposed to this degree of heat. Salting, smoking, or partial cooking is not sufficient to destroy the worms in all parts of the food, and they have even been found living in putrefied meat. This may serve to account in some cases for the serious symptoms which have followed the use of pork as food, also of bacon, sausages, and German sausages which are generally made of raw ham.

The symptoms produced by the use of such food are, in the first stage, those of intestinal irritation, loss of appetite, sickness, pain, general weakness of the limbs, diarrhœa, swelling of the eyelids and of the joints, profuse clammy perspiration, and wasting fever. Death is either the result of paralysis (from destruction of the muscular fibres) or of peritonitis and irritative fever. During the perforation of the coat of the intestines by these worms, the mucous membrane becomes irritated and inflamed: pus is formed on its surface, and bloody evacuations are sometimes passed.

Mr. Taylor directed attention (Sept. 1862) to the serious symptoms produced by *Canadian partridges* eaten as food. A lady who had partaken of this food was, in about two hours and a half, attacked with the following symptoms: She had sickness and became insensible; the skin was cold and no pulse could be felt. She was in a hopeless state for some hours, and only slowly recovered. The birds were quite fresh, having been packed in ice. In another case there were similar symptoms, with constriction of the throat and great pain. Animals were made ill by this food. It was believed that, in these cases, the birds had not been killed by poison, but that their flesh had been rendered poisonous by some vegetable which they had eaten. It is stated that in some parts of Australia the mutton is rendered poisonous by reason of the sheep feeding on poisonous plants. ('Med. Times and Gaz.,' 1871, 1, 728.) Pheasants which feed upon the Kalmia shrub are poisonous when eaten as food.

Ptomaïnes.—A class of bodies, known as *cadaveric alkaloids* or *ptomaïnes*, has within the last few years attracted much attention. They are found during the putrefaction of animal matters, and Selmi has directed attention to their significance in toxicology. The ptomaïnes are probably allied to neurine, an alkaloid obtained from the brain and from bile. Physiologically, some of them act like muscarine, the active alkaloid of the fly-fungus. It is probable that some of the cases of poisoning by putrid meat are ascribable to the formation of ptomaïnes during decay.

NEUROTIC POISONS.

CHAPTER 16.

OPIUM.—SYMPTOMS.—APPEARANCES.—ITS ACTION ON INFANTS.—POISONING WITH OPIATE COMPOUNDS.—OPIUM HABIT.—MORPHINE AND ITS SALTS.—MECONIC ACID.—PROCESS FOR DETECTING OPIUM IN ORGANIC MIXTURES.—DIALYSIS.—CHLORODYNE.

Opium.

Symptoms.—The symptoms which manifest themselves when a large dose of opium or its tincture has been taken, are in general of a uniform character. A condition of pleasurable mental excitement, usually of very short duration, is experienced; but this is followed by weariness, headache, incapacity for exertion, a sense of weight in the limbs, diminution of sensibility, giddiness, drowsiness, a strong tendency to sleep, stupor, succeeded by perfect insensibility, the person lying motionless, with the eyes closed as if in a sound sleep. In this state he may be easily roused by a loud noise, and made to answer a question; but he speedily relapses into stupor. In a later stage, when coma has supervened with stertorous breathing, it will be difficult, if not impossible, to rouse him. The pulse is at first small, quick, and irregular, the respiration hurried, and the skin warm and bathed in perspiration; but when the person becomes comatose, the breathing is slow and stertorous, and the pulse slow and full. The skin is occasionally cold and pallid, sometimes livid. The pupils, in the early stage, are contracted; in the last stage, and when progressing to a fatal termination, they may be found dilated. In a case referred to the author in 1846, one pupil was contracted and the other dilated. In infants and children they are generally much contracted. They are commonly insensible to light. The expression of the countenance is placid, pale, and ghastly;

the eyes are heavy, and the lips are vivid. Sometimes there is vomiting, or even purging; and, if vomiting takes place freely before stupor sets in, there is great hope of recovery. This symptom is chiefly observed when a large dose of opium has been taken; and it may then be, perhaps, ascribed to the mechanical effect of the poison on the stomach. The peculiar odour of opium is occasionally perceptible in the breath. Nausea and vomiting, with headache, loss of appetite, and lassitude, often follow on recovery. In cases likely to prove fatal the muscles of the limbs feel flabby and relaxed, the lower jaw drops, the pulse is feeble and imperceptible, the sphincters are in a state of relaxation, the pupils are unaffected by light, the temperature of the body is low, there is a loud mucous rattle in breathing, and convulsions are sometimes observed before death, but more commonly in children than in adults. One of the marked effects of this poison is to suspend all the secretions except that of the skin. Even during the lethargic state, the skin, although cold, is often copiously bathed in perspiration.

The contracted state of the pupils furnishes a valuable distinctive sign of poisoning with opium or the salts of morphine. In relying upon it, it is necessary, however, to bear in mind the fact pointed out by Wilks, that, in apoplexy seated in the Pons Varolii, the pupils are also contracted. He describes two cases of this form of apoplexy which were mistaken for poisoning with opium in consequence of this condition of the pupils. ('Med. Times and Gaz.,' 1863, i. p. 214.) In carbolic acid-poisoning the pupils are much contracted, though seldom so minutely as in opium-poisoning; and there is coma and stertorous breathing. As a rule, the peculiar odour of carbolic acid in the breath will prevent any mistake as to the nature of the case. The symptoms above described usually *commence* in from *half an hour* to *an hour* after the poison has been swallowed. Sometimes they come on in a few minutes, especially in children; and at other times their appearance is protracted for a long period. If morphia, the active alkaloid of opium, be given subcutaneously, narcotic symptoms may come on within three or four minutes. It has been frequently observed that a person has recovered from the first symptoms, and has then had a fatal relapse. There is some medico-legal interest connected with this state, which has been called secondary asphyxia from opium, although there appears to be no good reason for giving to it this name.

Appearances.—In a case that proved fatal in fifteen hours, the vessels of the head were found unusually congested throughout. On the surface of the fore part of the left hemisphere of the brain there was an ecchymosis, apparently produced by the effusion of a few drops of blood. There were numerous bloody points on the cut surface of the brain; there was no serum collected in the ventricles. The stomach was quite healthy. Fluidity of the blood is mentioned as a common appearance in cases of poisoning by opium. There is also engorgement of the lungs—most frequently observed, according to Christison, in those cases which have been preceded by convulsions. Among the external appearances there is often great lividity of the skin. Extravasation of blood on the brain is rarely seen; serous effusions in the ventricles, or between the membranes, are sometimes found. The stomach is so seldom found otherwise than in a healthy state that the inflammatory redness said to have been occasionally seen may have been due to accidental causes. From this account of the appearances in the dead body, it will be perceived that there is nothing but a fulness of the vessels of the brain which can be looked upon as specially indicative of poisoning with opium; and even this is not always present.

The medicinal *dose* of opium, in *extract* or *powder*, for a healthy adult, varies from half a grain to two grains. Five grains would be a very full dose. The medicinal dose of the *tincture* (laudanum) is from five to forty minims for an adult. Persons have taken very large doses of the tincture, and recovered from the effects. A woman, æt. 38, is said to have recovered after swallowing eight ounces. ('Lancet,' 1873, i. p. 468.) The *smallest dose of solid opium* which has been known to prove fatal to an adult was in the case of a man, æt. 32, who died very speedily in a convulsive fit, after having taken two pills, each containing about one grain and a quarter of extract of opium. This quantity is equivalent to *four grains* of crude opium. ('Med. Gaz.,' vol. 37, p. 236.) The *smallest fatal dose of the tincture* in an adult that the author found recorded, is *two drachms*. ('Ed. Med. and Surg. Jour.,' July, 1840.) The editor has known less than a grain of opium destroy life in an aged person. In connection with this subject it is important for a medical jurist to bear in mind that *infants* and young persons are liable to be killed by very small doses of opium; they appear to be peculiarly susceptible of the effects of this poison. The syrup of poppies, paregoric elixir, Godfrey's cordial, Dalby's carminative, and a variety of *soothing syrups* owe their narcotic effects to the presence of opium. The symptoms and appearances which they produce, when taken in a large dose, are similar to those caused by opium or its tincture. One-sixtieth part of a grain of opium has thus destroyed the life of an infant. ('Brit. Med. Jour.,' 1875, ii. p. 570.)

It has been remarked that most cases of poisoning with opium prove fatal in from about six to twelve hours. Those who recover from the stupor, and survive longer than this period, generally do well; but there may be a partial recovery, or a remission of the symptoms, and afterwards a fatal relapse. The symptoms, however, generally progress steadily to a fatal termination, or the stupor suddenly disappears, vomiting ensues, and the person recovers. Several instances are recorded of this poison having destroyed life in from seven to nine hours. One has occurred within the author's knowledge, in which an adult died in five hours after taking the drug prescribed for him by a quack. Christison met with a case which could not have lasted above five, and another is mentioned by him which only lasted three hours. Barwis communicated to the author the case of an adult, which proved fatal in three hours and a half. This drug in all its forms is especially fatal to infants. They die rapidly from very small doses.

Opium Habit.—It must be borne in mind by the medical jurist that persons may habituate themselves to the use of enormous doses of opium and its chief alkaloid morphine (opium-eating; morphine habit). The practice of subcutaneously injecting morphinel is very prevalent. Sixteen grains of morphine per diem is not a very unusual quantity to be habitually used by a person given to this degrading practice.

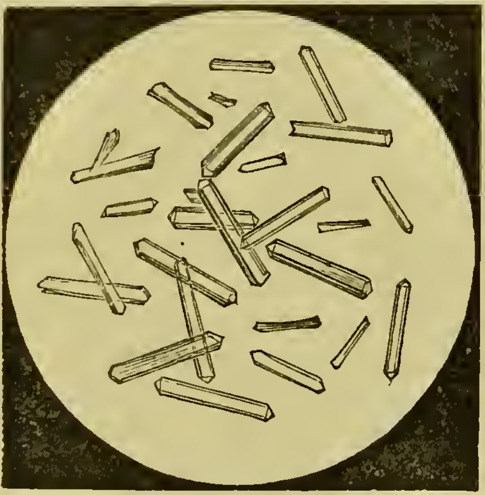
Morphine and its Salts.—Morphine (morphia) is the poisonous alkaloid of opium, of which it forms from five to ten per cent. The two principal salts of this alkaloid are the *hydrochlorate* and the *acetate.* Opium owes its narcotic properties chiefly to the presence of morphine in combination with meconic acid. A dose of one grain of a salt of morphine has destroyed life. Ebertz met with a case in which an overdose of the hydrochlorate, supplied by mistake for quinine, destroyed the life of a lady in from forty to fifty minutes. Symptoms of narcotism appeared in a quarter of an hour. (For a very full account of the appearances and analysis, see 'Vierteljahrsschr. f. Gerichtl. Med.,' 1873, 1, p. 281.)

Morphine and its salts rapidly destroy life by absorption when applied to a wounded or ulcerated surface. A woman thus lost her life in 1867, by reason of an ignorant druggist applying *thirty grains* of morphine to an ulcerated breast.

Chemical Analysis. Opium.—There are no means of detecting opium itself, either in its solid or liquid state, except by its smell, taste, and other physical properties, or by giving a portion of the suspected substance to an animal, and observing whether any narcotic effects are produced. The smell is said to be peculiar, but a similar smell is possessed by lactucarium, which contains neither meconic acid nor morphine. The *odour* is a good concomitant test of the presence of the drug, whether it be in a free state or dissolved in alcohol or water, but it is not perceptible by many people when the solution is much diluted. The taste is bitter. The analysis in cases of poisoning by opium is therefore limited to the detection of morphine and meconic acid.

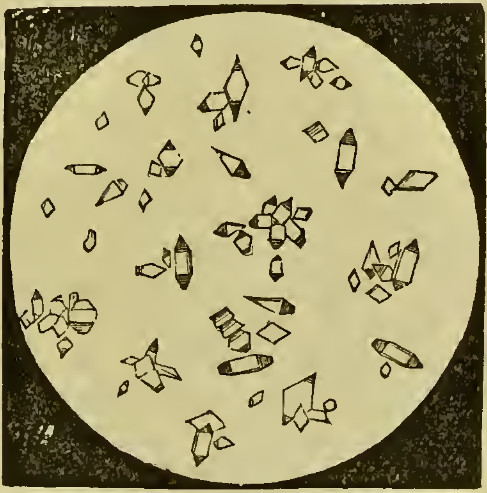
Morphine.—Morphine may be identified by the following properties:—1. It crystallizes in hexahedral prisms, which are white and perfect, according to their degree of purity (Fig. 19, p. 167). The crystals obtained by adding weak ammonia to a solution of morphine in hydrochloric acid vary in form. When slowly produced they sometimes present the forms represented in the engraving (Fig. 20, p. 167). 2. When heated on platinum, the crystals melt, become dark-coloured, and burn like a resin with a yellow smoky flame, leaving a carbonaceous residue. If this experiment is performed in a small reduction-tube, it will be found, by employing test-paper, that ammonia is one of the products of decomposition. 3. It is scarcely soluble in cold water, as it requires 1000 parts to dissolve it; it is soluble in 500 parts of boiling water, and the hot solution has a faint alkaline reaction. By its great insolubility in water it is readily known from its salts. It is not very soluble in ether or chloroform, thus differing from narcotine; but it is dissolved by fifty parts of cold, and thirty parts of boiling, alcohol. It is dissolved by a solution of potash or soda, from which it cannot be easily removed by ether. It is very soluble in acetic ether, and this liquid has been employed for the purpose of separating morphine from organic liquids. 4. It is easily dissolved by a very small quantity of all diluted acids, mineral and vegetable. 5. Morphine and its solutions have a bitter taste. 6. The salts of morphine are not precipitated in a crystalline form by solutions of sulphocyanide of potassium, ferricyanide of potassium, or chromate of potassium. In this respect they are strikingly distinguished from the salts of strychnine, which give well-marked crystalline precipitates with these three reagents. Like all alkaloids, the morphine in solution is thrown down white by the chlor-iodide of potassium and mercury (made by dissolving twenty-four grains of corrosive sublimate and eighty-eight grains of iodide of potassium in four ounces of water). This liquid precipitates albumen; hence this substance, if present, should be removed by boiling the liquid before applying the test.

Fig. 19.



Crystals of Morphine, from alcohol, magnified 80 diameters.

Fig. 20.



Crystals of Morphine, obtained by adding Ammonia to a solution of the hydrochlorate, magnified 124 diameters.

In order to apply the test for morphine, the alkaloid may be dissolved in a few drops of a diluted acid, either acetic or hydrochloric. If the hydrochlorate or the acetate of morphine is presented for analysis, the salt may be at once dissolved in a small quantity of warm water. The tests for this alkaloid are the following:—1. *Nitric acid.* This, when added to a moderately strong solution of a salt of morphine, produces slowly a deep orange-red colour. If added to the crystals of morphine or its salts, red fumes are evolved; the alkaloid is entirely dissolved, and the solution acquires instantly the deep-red colour above described, becoming, however, lighter on standing. In order that this effect should follow, the solution of morphine must not be too much diluted, and the acid must be strong and added in rather large quantity. The colour is rendered much lighter by boiling; therefore the test should never be added to a hot solution. 2. *Iodic acid* with *disulphide of carbon.* A solution of iodic acid should be mixed with its volume of disulphide of carbon. There should be no change of colour. On adding a small quantity of these mixed liquids to morphine or its salts, either solid or in solution, the iodine is separated from the iodic acid and dissolved by the disulphide, which sinks to the bottom, acquiring a pink colour, varying in intensity according to the quantity of morphine present. This reaction distinguishes morphine from the other alkaloids, which do not decompose iodic acid. The presence of morphine may be thus easily detected, in spite of the presence of organic matter, in one drop of the tincture of opium, in chlorodyne, or other opiate liquids. If disulphide of carbon is not used, iodine may be detected by its odour. 3. *Sulphomolybdic acid.* This is made by dissolving, with a gentle heat, about one-eighth of a grain of powdered molybdic acid in a drachm of pure concentrated sulphuric acid. The liquid should be freshly prepared and kept from contact with air and organic matter. When one or two drops are rubbed with *dry* morphine or any of its salts, an intense reddish-purple or crimson colour is produced. This changes to a dingy green and ultimately to a splendid sapphire blue. 4. *Sulphuric acid* and *bichromate of potassium.* When strong sulphuric acid is poured on pure morphine in a solid state, there is either no effect, or the alkaloid acquires a light pinkish colour. On adding to this a drop of solution of potassium bichromate, or a small fragment of a crystal, it immediately becomes green, and retains this colour for some time.

Meconic Acid.—This is a solid crystalline acid, seen commonly in scaly white crystals. It is combined with morphine in opium, of which it forms on an average six per cent., and it serves to render this alkaloid soluble in water and other menstrua. *Tests.*—Many tests have been proposed for meconic acid; but there is only one upon which any reliance can be placed, namely, the *ferric chloride.* This test produces, even in a diluted solution of meconic acid, a deep-red colour; and it is owing to the presence of this acid that a salt of iron strikes a red colour in tincture and infusion of opium, as well as in all liquids containing traces of meconate of morphine. The red colour of the ferric meconate is not easily destroyed by diluted mineral acids, by a solution of corrosive sublimate, or by chloride of gold, but it is by sulphurous acid and stannous chloride. In liquids containing tannin, *e.g.* tea or beer, the action of this test is obscured; but a small quantity of dilute sulphuric acid will remove the tannate of iron and bring out the red colour of the meconate.

Detection of Opium in organic mixtures.—Opium itself may be regarded as an organic solid, containing the poisonous salt which we wish to extract. It is not always that, in fatal cases of poisoning by opium or its tincture, even when these are taken in large quantity and death is speedy, we can succeed in detecting meconate of morphine in the stomach. The poison is probably removed by vomiting or absorption. Although this absence of the poison from the stomach is now a well-known fact, there is a popular prejudice that, unless found, there is a failure of proof that the death was caused by opium. In the cases of young children who are killed by a very small quantity of this drug, it is the exception to the rule to find any clear evidence of opium, but more common to find morphine in minute quantity. Its detection must in all cases depend on the quantity taken, the rate of absorption, and the time during which the person survived. At the trial of *Chantrelle* (High Court of Just., Edin., May, 1878), no trace of opium was found in the body, but there was distinct evidence of the presence of morphine and meconic acid, in certain stains on the sheets of the bed on which deceased was lying. Although made a strong point for the defence, the absence of opium from the stomach was really an unimportant item in the case. The evidence tended to show that the poison had been administered in the form of fluid extract—a form most favourable to absorption; that the quantity administered was small; that the deceased survived fifteen or sixteen hours, and that she had vomited during this time. These conditions are all consistent with the rapid removal of opium from the stomach. The evidence which was here wanting was fully supplemented by the detection of morphine and meconic aid in the stains on the sheets. The prisoner was convicted, and executed, in spite of the strenuous efforts made to invalidate the medical evidence.

If the matter is solid, it should be cut into small slices; if liquid, evaporated to an extract; and, in either case, digested with a large quantity of rectified spirit slightly acidulated with acetic acid. The residue should be well pressed in linen; the alcoholic liquid should then be evaporated in a water-bath until it is almost dry. The residue should be digested in water filtered and treated with acetate of lead, until there is no further precipitation. This liquid should be warmed and filtered; meconate of lead is left on the filter, while any morphine passes through under the form of acetate. The surplus acetate of lead, dissolved in the filtered liquid (containing the morphine), should now be precipitated by a current of sulphuretted hydrogen gas—the black sulphide of lead separated by filtration, and the filtered liquid evaporated at a very gentle heat to an extract, so that any sulphuretted hydrogen may be entirely expelled. On treating this extract with alcohol, the acetate of morphine, if present in sufficient quantity, may be dissolved out and tested. If the alcoholic liquid is still much coloured, it may be again evaporated and taken up by water. Animal charcoal deprives it of colour, but at the same time it removes the morphine if this is in small quantity. If there is a sufficient quantity of pure acetate present, the addition of a drop of solution of ammonia to a portion of the liquid on a slide, will produce crystals of the form of slender prisms. The remainder may be tested by the nitric and iodic as well as by sulphomolybdic acid. The prismatic crystals obtained under these circumstances have nothing peculiar or definite in form. At the *Chantrelle* trial (*supra*) it was stated by an analyst that the crystals furnished better evidence of the presence of morphine than the colour-reactions of the acids. This statement is against all experience and authority. Admitting that prismatic crystals of morphine could be obtained from a few slight stains of opium on a sheet, no medical jurist would rely upon the form of these crystals as evidence of the presence of morphine until after he had tested them by one or more of the acids above mentioned. This frivolous objection to the chemical evidence was exposed and set aside in the cross-examination of the witness. (See 'Med. Times and Gaz.,' 1878, i. p. 719.)

A better plan is to treat the liquid by the modified plan of Stas (*vide* Strychnine, *post*), taking care to avoid excessive heat and the presence of free mineral acids; and then to extract with a mixture of equal volumes of acetic ether and ordinary ether, in which mixture morphine is freely soluble, though it is almost insoluble in ordinary ether. The alkaloidal residue obtained by evaporating the ethereal liquid may be tested, as above, for the presence of morphine.

The *meconate of lead* left on the filter and dried is readily decomposed by boiling it with a small quantity of diluted sulphuric acid; and in the filtered liquid, neutralized if necessary by an alkali, the meconic acid is easily detected by the iron-test. The detection of *meconic acid* is most important, for this has been found in no substance but opium. *Morphine* may be obtained in an impure state as a precipitate by adding ammonia to a concentrated solution of the opiate extract. It may be then purified by alcohol and tested.

Trial tests for both the alkaloid and acid should be first applied to the organic liquid, which may for this purpose be submitted to dialysis (see p. 74). The smell of opium may be entirely absent. Meconic acid may be detected by the action of a ferric salt on the organic liquid diluted, and morphine may be found byadding to a portion of this liquid, a mixture of iodic acid and disulphide of carbon. The disulphide acquires a pink colour by dissolving the iodine set free by morphine or its salts. The chief difficulty in the detection of meconic acid and morphine is that the alkaloid forms only one-tenth part of opium, is easily decomposed, and the quantity of opium present in an organic liquid is generally very small.

Chlorodyne.

A lady, æt. 23, had been accustomed to take the liquid for the relief of pain, in doses of as much as sixty drops. She was found dead in bed, and the cause of death was referred by her medical attendant to her having taken two doses without letting a sufficient interval elapse between them. ('Lancet,' 1871, ii. p. 697.) According to E. Smith, chlorodyne is thus constituted: chloroform four drachms, hydrochlorate of morphine twenty grains, ether two drachms, oil of peppermint eight minims, prussic acid six drachms, mixture of gum acacia one ounce, treacle four ounces. ('Lancet,' 1870, i. p. 72.) There is reason to believe that this compound is not uniform in composition. According to another formula, the tinctures of lobelia and capsicum, and extract of liquorice, are introduced. One sample on standing separated into two liquids—one light and of a pale straw colour, and the other heavy and of a brown colour and syrupy consistency. On evaporation it left half of its weight of solid residue as saccharine matter. Another sample remained in a thick syrupy state. A fluid drachm of the first sample left as a residue twenty-seven grains of a brown saccharine extract. Prussic acid may be detected in it by the action of the vapour on silver nitrate. Crystals of silver cyanide are obtained after some time. Morphine may be detected in it by shaking a portion with a mixture of carbon disulphide and iodic acid. The disulphide acquires a pink colour, owing to the liberation of iodine by the morphine.

CHAPTER 17.

PRUSSIC ACID.—SYMPTOMS AND APPEARANCES.—TESTS FOR THE ACID.—PROCESS FOR ORGANIC MIXTURES.—CYANIDE OF POTASSIUM.—ESSENTIAL OIL OF BITTER ALMONDS.—NITROBENZENE.—NITROGLYCERINE.

Hydrocyanic or Prussic Acid.

Symptoms.—This acid has a hot bitter taste and an odour resembling that of bitter almonds. The time at which the symptoms of poisoning commence varies, but it is generally very shortly after the poison has been swallowed. When a large dose has been taken, as from half an ounce to an ounce of the diluted acids (two to five per cent.), the symptoms usually commence in the act of swallowing, or within a few seconds. It is stated that a diluted is more rapidly absorbed than a stronger acid. It is rare that their appearance is delayed beyond *one or two minutes.* When the patient has been seen at this period, he has been perfectly insensible, the eyes fixed and glistening, the pupils dilated and unaffected by light, the limbs flaccid, the skin cold and covered with a clammy perspiration; there is convulsive breathing at long intervals, and the patient appears dead in the intermediate period; the pulse is imperceptible, and involuntary evacuations are occasionally passed. The respiration is slow, deep, gasping, and occasionally heaving or sobbing. It is generally convulsive, but when the coma or insensibility is profound, it may be stertorous. This was observed in a case which occurred to Christison. ('Edin. Month. Jour.,' Feb. 1850, p. 97.) Convulsions of the limbs and body, with a spasmodic closure of the jaw, are sometimes noticed among the symptoms.

The following cases present fair examples of the immediate effects of this poison in a large and fatal dose. A medical man swallowed seven drachms of the common prussic acid. He survived about four or five minutes. About two minutes after he had taken the poison, he was found lying on the floor senseless; there were no convulsions of the limbs or trunk, but a faint flickering motion was observed about the muscles of the lips. The breathing appeared to cease entirely for some seconds; it was then performed in convulsive fits, and the act of expiration was remarkably deep, and lasted for an unusual time. When the dose is large the breath commonly exhales a strong odour of the acid, and this is also perceptible in the room.

A medical student took a drachm and a half of Scheele's prussic acid. He was heard to call out once or twice, and a gentleman sleeping in the next room ran to his assistance. He was heard to fall from the sofa to the floor, and when picked up was found to be already insensible. Hilton Fagge saw him a little later—fifteen to thirty minutes after the poison was taken. He was then lying on a sofa, quite insensible. The limbs were paralyzed, and lay in any position in which they were placed; and they were free from all rigidity. The jaws were clenched. The pupils were normal. There were no convulsions, nor had there been any. The face was not livid. The pulse was very rapid, the respirations very infrequent. Cold water dashed on the face produced at each application deep respiratory efforts. An attempt to administer an emetic failed, in consequence of inability to swallow. Strong ammonia applied to the nostrils failed to produce the slightest stimulation. After a time the breathing became slower—seven respirations in a minute, and it was distinctly stertorous. The pulse became slower and markedly feebler; and now cold effusion failed to produce any effect. The respirations fell to four in a minute, the face became blue, and the pulse imperceptible at the wrist. Breathing ceased in from an hour to an hour and a half after the poison was swallowed. There was a marked odour of prussic acid in the room; but it was not noticed at first whether the breath smelt of the acid. ('Guy's Hosp. Rep.,' 1869, p. 259.)

Appearances.—The body when seen soon after death often exhales the odour of prussic acid; but if it has remained exposed before it is seen, and if it has been exposed to the open air or in a shower of rain, the odour may not be perceptible; again, the odour may be concealed by tobacco-smoke, peppermint, copaiba, or other powerful odours. *Externally*, the skin is commonly livid, or is tinged of a violet colour; the nails are blue, the fingers clenched, and the toes contracted; the jaws firmly closed, with foam or froth about the mouth, the face often pale, but sometimes bloated and swollen, and the eyes have been observed to be wide open, fixed, glassy, very prominent and glistening, with the pupils dilated; but a similar condition of the eyes has been observed in other kinds of violent death. *Internally*, the venous system is gorged with dark-coloured liquid blood; the stomach and intestines may be in their natural state; but in several instances they have been found more or less congested. The mucous membrane of the stomach may be intensely reddened throughout.

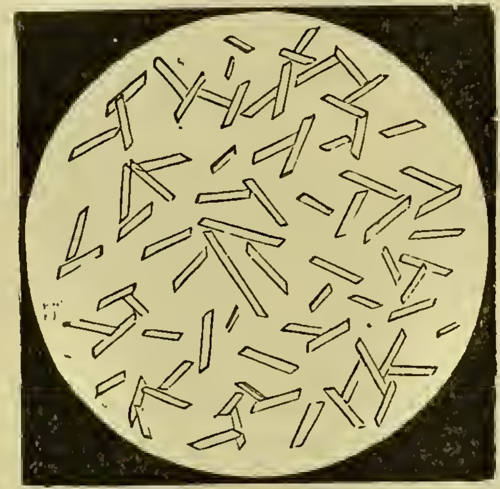
The *smallest* dose of this acid which is reported to have caused death was in the case of a healthy adult woman, who died in twenty minutes from a dose equivalent to *nine-tenths* of a grain of anhydrous prussic acid. ('Med. Gaz.,' vol. 35, p. 896.) This corresponds to about forty-five minims of the B. P. acid. In a case reported by T. Taylor ('Med. Gaz.,' vol. 36, p. 104), a stout healthy man swallowed this dose, *i.e.* nine-tenths of a grain, by mistake, and remained insensible for *four* *hours*, when he vomited and began to recover. From the facts hitherto observed, we shall not be wrong in assuming that a quantity of B. P. acid (at two per cent.) above fifty minims (*i.e.* one grain of anhydrous acid), or an equivalent proportion of any other acid, would commonly suffice to destroy the life of an adult. This is the nearest approach that we can make to the *smallest fatal dose.*

When a dose of half an ounce and upwards of the B. P. acid has been taken, we may probably take the average period for death at from *two* to *ten* minutes. In Hick's case, twenty grains of Scheele's acid (containing five per cent.) destroyed life in twenty minutes. It is only when a dose is just in a fatal proportion, that we find a person to survive from half an hour to an hour. In this respect, death by prussic acid is like death by lightning—the person in general either dies speedily or he recovers altogether. Before the access of insensibility the person often possesses a wonderful power of exertion and locomotion, perhaps in a state of half-consciousness. Thus he may be able to cork and conceal the bottle from which he has swallowed the poison; or he may run several yards before falling. Due allowance must be made for the performance of these voluntary acts. (See 'Brit. Med. Jour.,' 1877, i. p. 11.)

Chemical Analysis.—Two solutions of prussic acid are met with in British commerce—the British pharmacopœial acid ('B. P.' acid), containing two per cent. of the acid, and the so-called Scheele's acid, a stronger preparation containing about five per cent. These solutions are limpid like water, possess a faint acid reaction, and the vapour has a peculiar odour, which, when the acid is concentrated, although not at first perceptible, is sufficient to produce giddiness, insensibility, and other alarming symptoms. The tests which are best adapted for the detection of this poison, either in liquid or vapour, are equally applicable whether the acid is concentrated or diluted, and, so far as the detection of the *vapour* is concerned, whether the acid is pure or mixed with other liquids. *In the simple state*, the tests are three in number—the *Silver*, the *Iron*, and the *Sulphur* tests. 1. *The Silver-Test. Nitrate of Silver.*—This, added in excess, yields with prussic acid a dense white precipitate, speedily subsiding in heavy clots to the bottom of the vessel, and leaving the liquid almost clear. The precipitate is identified as cyanide of silver by the following properties:—*a.* It is insoluble in cold nitric acid; but when drained of water, and a sufficient quantity of the strong acid is added, it is easily dissolved on boiling. *b.* It evolves prussic acid when digested in hydrochloric acid. *c.* The precipitate, when *well dried*, and heated in a small reduction-tube, yields cyanogen, which may be burnt as it issues, producing a rose-red flame with a blue halo. This is a well-marked character, and at once identifies the acid which yielded the precipitate as prussic acid. Five grains by weight of the dry precipitate correspond to one grain of anhydrous prussic acid, to twenty grains of Scheele's acid, and fifty grains of the British pharmacopœial acid.

For the detection of prussic acid in *vapour*, hold over the liquid a watch-glass moistened in the centre with a drop of a solution of nitrate of silver. Cyanide of silver, indicated by the formation of an opaque white film in the solution, is immediately produced, if the acid is only in a moderate state of concentration. One drop of a diluted acid containing less than 1-50th of a grain of the anhydrous acid produces speedily a visible effect. When the prussic acid is more diluted, a few minutes are required; and the opaque film begins to show itself at the edges of the silver solution. In this case the action may be accelerated by the heat of the hand applied to the vessel. If the vapour is allowed to reach the nitrate of silver gradually and much diluted with air, then instead of an opaque film of cyanide of silver, crystals well defined under the microscope will be slowly produced, and these will constitute an additional proof of the presence of the acid in a state of vapour. As shown in the illustration (Fig. 21), these crystals have the form of slender prisms with oblique terminations. They often hang together in groups, and generally require a high magnifying power to render them visible.

Fig. 21.



Crystals of Cyanide of Silver from the vapour of prussic acid, magnified 124 diameters.

2. *The Iron-Test.*—The object of the application of this test is the production of *Prussian blue.* Add to a small quantity of the suspected poisonous liquid, a few drops of a solution of green sulphate of iron and a little solution of potash. A dirty-green or brownish precipitate falls; on shaking this with air for a few minutes, and then adding diluted hydrochloric or sulphuric acid, the liquid becomes blue; and Prussian blue, of its well-known colour, unaffected by diluted acids, slowly subsides.

3. *The Sulphur-Test.* A small quantity of yellow sulphide of ammonium is added to a few drops of a solution of prussic acid, and the mixture is gently warmed; it becomes colourless, and, on evaporation, leaves crystals of sulphocyanate of ammonium—the sulphocyanate being indicated by the intense blood-red colour produced on adding to the dry residue a solution of nearly neutral persalt of iron; this red colour immediately disappears on adding a few drops of a solution of corrosive sublimate.

The great utility of the *sulphur-test*, however, is in its application to the detection of the minutest portion of prussic acid when in a state of *vapour.* In this respect it surpasses in delicacy any other process yet discovered. In order to apply it, we place the diluted prussic acid in a watch-glass, and invert over it another watch-glass having in its centre one drop of yellow sulphide of ammonium. No change apparently takes place in the sulphide; but if the upper watch-glass is removed after the lapse of from half a minute to ten minutes, according to the quantity and strength of the prussic acid present, crystallized sulphocyanate of ammonium will be obtained on gently evaporating the drop of liquid to dryness. With an acid of from three to five per cent. the action is completed in ten seconds. The addition of one drop of neutral ferric sulphate or chloride (free from nitric acid) to the dried residue brings out the blood-red colour instantly, which is intense in proportion to the quantity of sulphocyanate present. (For some remarks on the application of this process to the detection of prussic acid, see 'Med. Gaz.,' 1847, vol. 39, p. 765.)

Prussic Acid in organic liquids. Detection by vapour without distillation.—The organic liquid may be placed in a short wide-mouthed bottle, to which a watch-glass has been previously fitted as a cover. The capacity of the bottle may be such as to allow the surface of the liquid to be within one or two inches of the concave surface of the watch-glass. The solution of *Nitrate of silver* is then used as a trial-test for the vapour in the manner above described. If the 1-200th of a grain of prussic acid is present, and not too largely diluted, it will be detected (at a temperature of 60° F.) by the drop of nitrate of silver being converted into an opaque white or crystalline film of cyanide of silver, the chemical change commencing at the margin. We may then substitute for the nitrate of silver yellow sulphide of ammonium, and proceed in the manner above described. In cold weather it may be necessary to place the bottle in a basin of warm water. If the solution of silver is tarnished by sulphuretted hydrogen, as a result of putrefaction, the sulphur-test alone should be used. By this process prussic acid has been detected in the stomach of a person poisoned by it, as late as twelve days after death. After the stomach has been exposed for a few days longer, the acid has entirely disappeared.

If traces of the poison are thus found, then the organic liquid should be distilled in a water-bath, and about one-fourth of the contents of the flask collected in a receiver kept cool by water. (For the form of apparatus, see p. 109, *ante.*) The tests may now be applied to the distilled liquid, which will have the odour of prussic acid.

In the tissues.—Soon after death the poison may be easily detected in the blood, secretions, or any of the soft organs, by placing them in a bottle, and collecting the vapour in the manner already described. This will be found more convenient and satisfactory than the process by distillation. The poison has been thus discovered, in experiments on animals, in the blood, and even in the serous exhalation of the chest.

If the body is in a putrefied state, the residuary prussic acid may have been converted into fixed sulphocyanate of ammonium. In order to detect this salt in the stomach or its contents, we should digest the parts finely cut up in hot alcohol, filter the alcoholic liquid, evaporate to dryness, and take up any crystalline residue with water. A solution of a persalt of iron added to this solution, will indicate the presence of a sulphocyanate by imparting to it an intensely red colour. The editor has detected prussic acid as a sulphocyanate in the blood many weeks after the death of a person who died from prussic acid-poisoning.

CYANIDE OF POTASSIUM.

Symptoms.—This salt has a bitter taste, producing first a sense of coldness on the tongue, followed by a feeling of constriction, and burning heat, in the throat. It is one of the most formidable poisons known to chemists. It has destroyed life in a quarter of an hour. A dose of five grains has proved fatal in three instances. In one case the person died in two hours. ('Chem. News,' Sept. 5, 1863.) The symptoms which the cyanide produces are similar to those occasioned by prussic acid — insensibility, spasmodic respiration, convulsions, with tetanic stiffness of the jaws and body. They appear in a few seconds or minutes, and run through their course with great rapidity.

Appearances.—In a case in which an inspection of the body was made two days after death, there was no remarkable odour: the muscles were rigid; the face and fore part of the trunk, pale; the back part livid, except those portions which had sustained pressure. The fingers and toes were convulsively bent inwards, the nails blue, the eyelids half closed, the lips pale, the vessels of the brain filled with bluish-red blood. On making a section of the brain and spinal marrow, numerous bloody points were observed. The lungs were congested posteriorly, and, on cutting into them, a strong odour of bitter almonds was perceived. A yellowish mucus was found in the stomach, which yielded on analysis cyanide of potassium. The mucous membrane was reddened near the intestinal end. The poison was not detected in any part of the body except the contents of the stomach and intestines. (Casper's 'Wochenschrift,' Oct. 4, 1845, 657.)

Cyanide of potassium has a local chemical action upon the skin; and if this is abraded or wounded, it may be absorbed and produce serious effects. Some accidents of this kind have occurred in the practice of photography. ('Ann. d'Hyg.,' 1863, vol. i. p. 454.) This poison has been found as an impurity in reduced iron (*Ferrum redactum*).

Analysis.—This substance is usually seen in hard white masses. It is deliquescent, and very soluble in water; the solution, when pure, is colourless, and has a strong alkaline reaction, a soapy feel, and a powerful odour of prussic acid. It is not very soluble in cold alcohol. 1. It is decomposed by all acids, and prussic acid is set free. 2. The potash is precipitated by tartaric acid and by platinic chloride. 3. It gives a white precipitate with nitrate of silver, which, when dried and heated, possesses all the properties of cyanide of silver (*ante*, p. 173). This precipitate is easily redissolved by a slight excess of the solution of cyanide of potassium. 4. If a solution of ferrous sulphate is added to a solution of the cyanide of potassium, and after agitation the mixture is treated with diluted sulphuric acid, Prussian blue will be produced.

ESSENTIAL OIL OF BITTER ALMONDS.

This liquid, which is used for the purpose of giving flavour and odour to confectionery, owes its poisonous properties chiefly to the presence of prussic acid. It contains a variable quantity of this poison, which has been found in it in a proportion of from eight to twelve per cent. *Almond flavour* or essence of peach-kernels contains one drachm of the essential oil to seven drachms of rectified spirit. The bitter almond itself operates as a poison. A boy who had eaten several almonds was found unconscious, cyanotic, and pale, with eyelids closed and pupils moderately dilated. The arms were stiffened with tonic spasm; the pulse trembling; and vomiting was excited by emetics. He went to sleep, and recovered in eighteen hours. ('Med. Times and Gaz.,' 1878, i. p. 37.) Peach-kernels operate in a similar manner. One ounce of the kernels is considered to be equal to one grain of prussic acid—a fatal dose.

Symptoms.—The following may be taken as a summary: insensibility; lividity of the face; eyes glassy, prominent, fixed, and staring; pupils dilated and insensible to light; jaws spasmodically closed; frothy mucus about the mouth, and in some cases vomiting; coldness of the skin; heaving, intermittent respiration, in some instances stertorous; absence of the pulse; head spasmodically drawn backwards, and sometimes the trunk; general relaxation of the limbs; an odour of bitter almonds about the mouth.

Appearances.—In one fatal case, no odour of almonds was perceptible, nine hours after death, in the chest, head, or heart, nor in the blood. The lungs and heart were healthy. The vessels of the brain were congested, and there was a general effusion of serum on the hemispheres. The lining membrane of the stomach was much congested. On opening it, the odour of bitter almonds was quite perceptible. ('Prov. Med. Jour.,' Sept. 11, 1844, p. 364.) The blood with which the venous system is gorged is generally liquid, and of a dark colour.

Analysis.—The *essential oil*, which is sometimes called peach-nut oil, is colourless when pure, but it commonly has a pale yellow colour, and a strong odour of bitter almonds, by which it may be at once identified. It has a hot burning taste, and a feebly acid reaction. The smell and taste are generally sufficient for its identification; but nitrobenzene possesses a similar odour, and has been mistaken for it. It produces, when dropped on paper, a greasy stain, which does not entirely disappear by the application of heat. It has a sp. gr. of 1·043; hence it sinks in water, which dissolves about one-thirtieth part. It is soluble in alcohol and in ether in all proportions. When mixed with a few drops of strong sulphuric acid, it forms a rich crimson-red liquid, which, if exposed to air, acquires a yellow colour. Prussic acid may be detected in it by dissolving the oil in alcohol, and adding solutions of green sulphate of iron and of potash. On the subsequent addition of diluted hydrochloric acid, Prussian blue is formed.

NITROBENZENE.

Nitrobenzene, Nitrobenzol, or *Essence of Mirbane*, is a liquid which is largely employed as a substitute for the essential oil of bitter almonds in perfumery and confectionery, and is a formidable poison. It has been mistaken for essential oil of bitter almonds, but its mode of operation is different. In 1859, Casper published an account of this liquid under the name of 'A New Poison.' ('Vierteljahrsschr. f. Gerichhtl. Med.,' B. 16, p. 1.) It is also largely employed in the manufacture of aniline colours.

Symptoms.—The cases which have yet occurred show that this is an insidious poison, both in the form of liquid and vapour. It produces a burning taste in the mouth, followed by a sensation of numbness and tingling in the tongue and lips. There is no immediate insensibility, as in poisoning by prussic acid. The eyes are bright and glassy, the features pale and ghastly, the lips and nails purple, as if stained by blackberries, the skin clammy and the pulse feeble. There is a powerful odour resembling that of oil of bitter almonds. The mind may be clear for an hour, or for several hours, after the poison has been swallowed. The patient then becomes suddenly unconscious—the jaws fixed—the hands clenched and blue, and the muscles rigid and convulsed. In one case there was vomiting of a liquid having the odour of nitrobenzene. The breathing was slow and the pulse scarcely perceptible. Reaction set in, in about eleven hours, and recovery took place. ('Guy's Hosp. Rep.,' 1864, p. 192.) In a fatal case examined by Letheby, the *appearances* were as follows: the superficial vessels were much gorged with blood, which was black and fluid. The lungs were congested, the cavities of the heart were full of blood, the liver was of a purple colour, the brain and its membranes were congested, and there was much bloody serosity in the ventricles. Lehmann reported the symptoms and appearances in a fatal case. ('Ann. d'Hyg.,' 1873, 1, p. 444.) In 1876, a man, æt. 21, was prescribed three-minim doses of 'benzol rect.' three times a day. By mistake, the dispenser read the prescription as ordering 'benzol nit.,' and gave nitrobenzol (nitrobenzene). The first day he took these doses the patient was observed to look a little pale and weak, but he was not conscious of feeling ill till after taking the seventh dose at 9 a.m. next day. The aggregate amount of nitrobenzene now taken was ascertained to be twenty-three minims. At 2 p.m., five hours after taking this final dose, after walking not more than forty yards in the street from his office, he fell down. He was just able to give his address, and then became insensible. At 3.15 p.m., when seen by Gross, he was cold, and the surface of the body was bluish purple. There was no pulse, but by the stethoscope the heart could just be heard faintly beating. The lower jaw was rigidly closed; but the limbs were flaccid and dropped powerless when raised; the pupils were widely dilated. No breathing could be perceived for twenty minutes after this. He was treated as for prussic acid-poisoning, it being thought that the poison was oil of bitter almonds. At 7 p.m. he became conscious and complained of headache. At 9 p.m. the skin was still blue. Next day he was fairly convalescent. From the urine collected on the morning following the accident, the editor extracted a substance having the odour of nitrobenzene. ('Guy's Hosp. Rep.,' 1876, p. 371.)

This compound has a narcotic action, but it differs from the ordinary narcotics in its powerful and persistent odour, which would render it difficult for a person to administer it unknowingly to another, either in liquid or vapour; in the production of profound coma at an uncertain interval after the stupor; and in the rapidly fatal effects when coma has followed. It operates powerfully as a poison in vapour, as well as in a liquid state; but so far as cases have been yet observed in the human subject, the symptoms resembling those of the first stage of narcotic poisoning have very soon appeared. The rapidly fatal cases only would be likely to be mistaken for apoplexy, but in these the poison would be detected by its odour.

Analysis.—Nitrobenzene, or *Essence of Mirbane*, is a pale lemon-coloured liquid of a strong odour resembling that of bitter almonds. It has a pungent, hot, disagreeable taste. It gives to confectionery and soap the smell of oil of bitter almonds. It gives a greasy stain to paper. It sinks in water, and is partly dissolved, imparting to it a yellowish colour. It is soluble in alcohol, ether, and chloroform; but, when agitated with water, it is in great part separated from its ethereal and chloroformic solutions. It burns with a yellow smoky flame. It yields no Prussian blue when mixed with sulphate of iron, alcohol, and potash, and then acidulated. It is distinguished from all other liquids, excepting the essential oil of almonds, by its odour, and from this oil by the following test:—pour a few drops of each on a small plate, and add a drop of strong sulphuric acid. The oil of almonds acquires a rich crimson colour with a yellow border; the nitrobenzene produces no colour. In order to separate it from organic liquids, they may be acidulated with sulphuric acid, and submitted to distillation. It may be converted into aniline, and submitted to further tests.

NITROGLYCERINE (GLONOIN).

This is a sweet, oily, powerfully explosive liquid, well known to chemists as a substitution-compound of the innoxious liquid, glycerine. It is much used in mining, under the name of 'blasting oil,' and has a sweet, aromatic, pungent taste. Mixed with an infusorial earth, it is known as dynamite. The medicinal dose is one or two hundredths of a grain.

Symptoms and Appearances.—Field states that he found one drop of the liquid dissolved in water produced insensibility and other symptoms of narcotic poisoning ('Chem. News,' Nov. 7, 1863); and that one-fiftieth of a minim produced in three minutes loud noises in the head, and other distressing symptoms. Murrell has found that one or two minims of a one-per-cent. solution of nitroglycerine produces painful pulsation over the whole head; the pulsation soon affects the whole body, and is so marked that a pen held in the hand becomes visibly jerked. In five minutes these symptoms are followed by intense headache, languor, and depression. Nitroglycerine is now employed in medicine in lieu of amyl-nitrite, which it greatly resembles in its effects, except that these are more lasting. The editor has seen the most distressing results ensue from an overdose, the headache being of an alarming and fearful character.

Nitroglycerine has in several instances been the cause of accidental death. It is sweet, colourless, and apparently innocent in appearance; and these properties render it liable to be taken in mistake for other liquids of a less potent character. In 1864, a girl, æt. 13, died after drinking some of it from a flask. A man drank a considerable quantity of the liquid in mistake for beer. An hour later he was blue in the face and insensible. When admitted into hospital he was delirious and unconscious, and speedily became comatose. The hands were frequently raised to the head, as if there was headache. The face was red and swollen. He died six hours after swallowing the poison. The brain and its membranes were congested; and there was some yellow serous fluid in the ventricles. The lungs were œdematous, the windpipe, stomach, and kidneys reddened. Signs of irritation were also noted in the small intestines. There were numerous small ecchymosed spots on the fundus and larger end of the stomach. In a third case, a man drank some glonoin in mistake for brandy, and died in three hours. In a fourth case a man recovered after swallowing a considerable quantity of the poison. (Schmidt's 'Jahresber.,' 136, p. 164.)

Analysis.—Nitroglycerine is a heavy, oily-looking liquid. It dissolves in water, but is insoluble in alcohol and ether. It explodes violently when struck or subjected to concussion. Nitroglycerine yields a red colour when treated with aniline and strong sulphuric acid; and also a red colour when treated with brucine and strong sulphuric acid (free from nitric acid).

CHAPTER 18.

ALCOHOL.—ETHER.—CHLOROFORM.—IODOFORM.—HYDRATE OF CHLORAL.—CAMPHOR.

Alcohol.

Symptoms.—In general the symptoms produced in poisoning with alcohol come on in the course of a few minutes. There is confusion of thought, with inability to stand or walk, a tottering gait and giddiness, followed by stupor and coma. Should the person recover from this stage, vomiting supervenes. The insensibility produced by alcohol may not come on until after some time, and then suddenly. Christison met with an instance in which a person fell suddenly into a deep stupor some time after he had swallowed sixteen ounces of whisky; there were none of the usual premonitory symptoms. In another instance, a person may apparently recover from the first effects, then suddenly become insensible, and die convulsed. There is a ghastly or vacant expression on the features, which are sometimes suffused and bloated, the lips are livid, and the pupils are dilated and fixed; if they possess the power of contracting under the influence of light, it is a favourable sign. The conjunctivæ or whites of the eyes are generally much suffused. The breath has an alcoholic odour. The more concentrated the alcohol, the more rapidly are the symptoms induced, and they are also more severe in their character. Diluted alcohol commonly produces a stage of excitement before stupor, while in the action of concentrated alcohol there may be profound coma in a few minutes. The cause of death may be generally traced to congestion of the brain or lungs, or both. Sometimes a large dose may be taken without causing death. A child, æt. 4, swallowed between two and three ounces of brandy. He was found insensible, the breathing was scarcely perceptible, and the pupils were widely dilated. Under treatment he recovered in two days. ('Lancet,' 1872, ii. p. 76.)

The symptoms arising from apoplexy, from concussion of the brain, the effects of opium, or those of carbolic acid, have been sometimes mistaken for those of poisoning by alcohol, and persons have been wrongly charged with being drunk. With respect to *concussion*, a difficulty can arise only in reference to the more advanced stage of poisoning with alcohol, *i.e.* in which there is profound coma. Intoxication may in general be easily distinguished by the odour of the breath, for so long as the symptoms continue, alcohol is eliminated by the lungs. If there should be no perceptible odour of any alcoholic liquid, the presumption is that the symptoms are not due to intoxication. When the alcoholic odour is perceptible, the symptoms may still be combined with the effects of apoplexy or concussion—a fact which can be cleared up only by a history of the case, or a careful examination of the head for marks of violence. In poisoning with *opium* there will be a strong smell of this drug in the breath, the symptoms come on much more gradually, and are marked by drowsiness and stupor, passing into complete lethargy, with general relaxation of the muscles, and inability to walk. In poisoning with alcohol there is either great excitement some time before the stupor, which comes on suddenly, or the person is found in a state of deep coma a few minutes after having taken the poison. In poisoning with opium the face is pale, and the pupils are contracted; in poisoning with alcohol the face, under excitement, is more commonly flushed, and the pupils are generally dilated. Another fact to be noticed is that, while perfect remissions are rare in poisoning with opium, in poisoning with alcohol a person frequently recovers his senses, and dies subsequently. When coma has supervened, the patient may be aroused by a loud noise or a violent shock in either case, and it is very difficult under these circumstances to draw a well-marked distinction. The odour of the breath, or an examination of the fluid drawn from the stomach by the pump, may then show which poison has been taken; but the treatment is the same in both cases. In poisoning with carbolic acid there is the characteristic odour of the acid in the breath, a white furred or shrivelled tongue, and white or brown stains about the angles of the mouth.

Alcohol may act as a poison by its *vapour*. If the concentrated vapour be respired, it will produce the usual effects of intoxication. There is a case on record in which a child two years of age was thrown into an apoplectic stupor by the alcoholic vapour of eau de Cologne.

In this manner a child might be destroyed, and no trace of the poison found in the stomach.

Appearances.—The stomach has been found intensely congested or inflamed, the mucous membrane presenting in one case a bright red, and in another a dark red-brown colour. When death has taken place rapidly, there may be the special odour of the kind of spirits taken in the contents; but this will not be perceived if the quantity taken was small, or many hours have elapsed before the inspection is made. The brain and its membranes are found congested, and, in some instances, there is effusion of blood or serum beneath the inner membrane (*pia mater*).

Analysis.—When a large dose has been taken, and the case has proved rapidly fatal, the contents of the stomach may have the odour of alcohol, or of the alcoholic liquid taken. The odour, however, is not always perceptible, and it may be easily concealed by other odours. In a case of poisoning with gin, the liquid drawn from the stomach by the pump after seven hours had no odour. The smell of brandy has entirely disappeared in twelve hours.

The contents of the stomach or the suspected liquid should be distilled in a water-bath, with a proper condensing apparatus attached (Fig. 8, p. 109). If the liquid has an acid reaction, it should be first neutralized with a solution of carbonate of sodium. The watery distillate obtained should be submitted to a second distillation in a smaller retort heated by a water-bath. The liquid obtained by the second distillation may be identified by its odour, taste, and imflammability. Its specific gravity should be taken, and from this the percentage of alcohol may be deduced by tables. (See 'SPIRIT-GRAVITIES,' by T. Stevenson.) Alcohol may be recognized by the two following tests:—1. Mix a little of the distillate with enough solution of bichromate of potassium to give it a good orange colour. Now pour in an equal volume of strong sulphuric acid, and gently agitate the tube so as to mix the solutions; if alcohol be present, the liquid will become green, and the peculiar odour of aldehyd will be perceived. 2. To a portion of the distillate add some solution of potash, and then a solution of iodine in iodide of potassium till a permanent brown tint is obtained. Now add enough of the potash solution to discharge the colour, and warm gently. If alcohol be present, a turbidity will appear in the solution, but will disappear as the boiling point is approached; and the peculiar odour of iodoform will be perceived. On cooling and standing for some hours, the iodoform will settle to the bottom of the vessel in the form of beautiful rosetted crystals.

ETHER.

Symptoms and Effects.—Ether, in moderate doses, has a hot burning taste, and produces, during swallowing, a sense of heat and constriction in the throat. It causes, like alcohol, great excitement and exhilaration, with subsequent intoxication; but persons may become habituated to its use, and thus, after a time, it may be taken in large quantities with comparative impunity. The effects produced on the system, when a large dose has been taken, are similar to those occasioned by alcohol. Ether as a *liquid* has not, so far as is known, directly destroyed the life of a human being; but when its vapour has been breathed, it has caused death in several instances. (See 'ON POISON,' 3rd edit., p. 639; also 'Brit. Med. Jour.,' 1877, ii. p. 692; 1875, i. p. 585.)

Analysis.—When ether has been taken as a liquid, it may be separated from the contents of the stomach by the process described for alcohol. It is well known by its odour and inflammability.

Spirit of Nitrous Ether.—This compound is well known under the name of sweet spirit of nitre. It may be regarded as a solution of nitrous ether in rectified spirit. In 1878 a child, about three years old, drank between three and four ounces of sweet spirit of nitre. He was soon afterwards found in a state of complete collapse—cold, pulseless, and insensible; both pupils were widely dilated and fixed, and the breathing was hardly perceptible. Before this the child had vomited undigested food, with a smell of spirit, and the bowels had been opened. In spite of some reaction under treatment, there was no sign of recovery: the breathing became stertorous, and the child died twelve hours after swallowing the liquid. On inspection, there was a strong smell of spirit; the mucous coat of the stomach was inflamed, as well as that of the duodenum. The membranes of the brain were highly congested, the vessels containing a large quantity of dark-coloured blood. The operation of this liquid resembled that of a mixture of alcohol and ether. This is the only fatal case which we have met with.

CHLOROFORM.

Symptoms.—Chloroform, when swallowed, acts very uncertainly. As it is a liquid very sparingly soluble in water, and much more soluble in alcoholic liquids, it is not surprising that the greater or less fulness of the stomach, and the nature of its contents when the poison is swallowed, greatly influence the result. The author regarded it as a not very active poison. In this opinion the editor cannot concur, since he has collected the reports of sixty-two cases, of which no less than nineteen proved fatal, or thirty per cent. Eliot has tabulated fifty-six undoubted published cases. ('New York Med. Rec.,' 1885, ii. p. 29.) The effects of chloroform when swallowed do not greatly differ from the severe effects of the inhaled liquid, except that the symptoms are more intensified, and last longer. Chloroform-poisoning is nearly always the result of accident or suicide; but in Feb. 1886, two persons were committed for trial on a coroner's inquisition for the alleged murder of a man by means of chloroform. A case is also reported of the murder of a woman by her lover by means of inhaled chloroform. The man subsequently shot himself. There is reason to think, however, that this was a case of attempted concerted simultaneous suicide. (Casper's 'Handb. d. Gerichtl. Med.,' 6 Auf. ii. p. 557.)

The pungent odour, sweet taste, and intense burning sensation which its contact with the mucous membranes instantaneously produces, would render the homicidal administration of chloroform by the mouth difficult, except the person were first chloroformed by inhalation. That persons can be successfully chloroformed during sound sleep has repeatedly been put to the test. (Hussey, 'Med. Times and Gaz.,' 1880, ii. p. 251; Dolbeau, 'Ann. d'Hyg.,' 1874, t. 1, p. 168; Quimby, 'Boston Med. Jour.,' June 17, 1880; Eliot, 'New York Med. Rec.,' 1885, ii. p. 29.)

The most prominent symptoms of chloroform-poisoning are, after a transient state of excitement or inebriation, muscular relaxation, abolition of sensation and consciousness—which may supervene within five minutes, though it is usually longer delayed—and profound narcosis with stertorous respiration. The pupils of the eye may be contracted or dilated. Reflex excitability is eventually abolished. Usually, if the stomach be evacuated, the patient recovers; and fortunately chloroform commonly excites vomiting. But no vomiting may be excited by even a large dose ('Canada Lancet,' 1874, vi. p. 209); and death may result under such circumstances. Chloroform appears to destroy life by paralysing the action of the heart or lungs, or both organs.

A boy, æt. 4, swallowed *a drachm or two* of chloroform, laid his head on his mother's lap soon afterwards, and then lost all consciousness. In about twenty minutes he was insensible, cold, and pulseless. Mustard poultices applied to his legs produced no impression or sensibility. The breathing was sometimes natural, at other times stertorous. He died in three hours. This is the *smallest fatal dose* recorded. Hofmann met with a case where 35-40 grammes, or 6-7 fluid drachms, proved fatal to an adult. This is the smallest fatal dose recorded in the case of an adult. One fluid ounce has in several cases killed an adult. Death has ensued at periods ranging from one hour to eight days. The post-mortem appearances are congestion, inflammation, and even ulceration of the lining membrane of the stomach; congestion of the mucous membrane of the bowels, and sometimes congestion of the lungs and of the brain. The blood is sometimes unusually fluid, and the post-mortem staining of the heart well marked. There is, however, nothing characteristic except the odour of chloroform in the alimentary canal.

H. C. Wood, jun., nearly killed a patient by the deep injection of half a drachm of chloroform. ('Therapeutics,' 2nd edit., p. 280.)

Chloroform Vapour.—This vapour, when respired in a concentrated form, is speedily fatal to life. If it is diluted with a certain proportion of air, it produces insensibility, with entire loss of muscular power, and the patient rapidly recovers after the vapour is withdrawn. Cases of death from the inhalation of the vapour for surgical purposes have been numerous, and the symptoms and post-mortem appearances are not always well marked. In some instances death has taken place within two minutes from the commencement of inhalation. In one in which only *thirty drops* had been inhaled in vapour, the patient died in one minute, and in another so small a quantity as fifteen or twenty drops proved speedily fatal. Its fatal effects do not depend so much on the absolute quantity, as on the proportion in which it is breathed in a state of mixture with atmospheric air. It has been stated that the average proportion of this vapour for medicinal purposes should not exceed 3½ per cent., and that 4½ is a maximum quantity to be taken with safety. The proportion should be only slowly increased. The vapour should not be given after a full meal, or while the person is in a sitting or erect posture. ('Brit. Med. Jour.,' 1875, ii. p. 778.) The vapour of this liquid, operating through the lungs, has destroyed life more rapidly, and in a smaller dose, than any other poison known. Its fatal operation is sometimes suddenly manifested after the withdrawal of the vapour. It is thought that 20 minims in the blood at one time would prove fatal. It is to a fatty condition or flabby heart that the fatal effects are usually and often incorrectly ascribed. The theory of a flabby heart is quite unnecessary to explain the fatal results occasionally produced by chloroform vapour, even when administered by experienced persons.

In cases of alleged robbery and rape, it has been sometimes stated that the person assaulted was rendered suddenly insensible by chloroform; but chloroform vapour does not produce immediate insensibility, unless it also produces asphyxia and death. There can be no doubt that several false charges of rape have been made against medical men and dentists under the alleged use of this vapour. In general the statement of the woman alone has been sufficient to show the falsehood of the charge.

Analysis.—Chloroform is a heavy colourless liquid, sp. gr. 1·5, neutral in its reaction, sinking in water in heavy oily-looking globules, and only to a slight extent dissolving in this liquid. It has a peculiar fragrant odour. It is very volatile, but not readily combustible. It may be separated from other liquids by distillation at a low temperature. It boils at 142° F., and evolves a vapour which, at a red heat, yields chlorine and hydrochloric acids. On this effect is founded a process for the detection of chloroform in the blood, when it has proved fatal in the form of vapour. The editor has by this method succeeded in detecting chloroform in the blood of a man twenty-four hours after death from the administration of chloroform as an anæsthetic vapour. (See 'Princ. and Pract. of Med. Jurispr.,' vol. i. p. 406.) In organic liquids it may be converted into chloride by the action of alcoholic potash, and the chlorides may then be estimated by precipitation with nitrate of silver. Chloroform is mixable in all proportions with alcohol, but not with diluted spirit. Proof spirit dissolves 15 per cent. by volume of chloroform; whereas spirit of 25 per cent. under proof—the minimum statutory strength of brandy—takes up only 2 per cent.

IODOFORM.

This antiseptic is a poison. Schede, Kocher, and others have published cases where severe and even fatal symptoms have followed its external application. Boyd has still more recently reported four cases where toxic symptoms were developed after its use as a surgical dressing. These symptoms were, in two cases, drowsiness and stupor; in one, those of meningitis; and delirium in a fourth case, which terminated fatally.

Symptoms and Appearances.—The symptoms usually observed after poisonous doses are—faintness, headache, giddiness, confusion of ideas, drowsiness, burning pain in the stomach, delirium, convulsions, insensibility, general paralysis, a small pulse sometimes quickened and sometimes diminished in frequency, and the skin cold and livid, bathed in perspiration. (‘Brit. Med. Jour.,’ 1882, i. pp. 903, 913.)

Hydrate of Chloral.

This substance, in doses of from twenty to thirty grains, operates as a sedative and narcotic. In very large doses, it has caused dangerous symptoms, followed by sudden death. Medical men who have taken it incautiously have died from its effects. Two instances of this kind are reported in the ‘Med. Times and Gaz.’ (1871, i. p. 367). No remarkable symptoms have preceded dissolution. The person has passed at once from sleep into death.

Symptoms.—This compound produces after a short interval deep sleep, and, when carried far enough, complete loss of consciousness and sensibility. A lady took six doses of thirty grains each, and fell into a sound sleep. Every attempt failed to arouse her, and she slept into death. The principal post-mortem appearance was great congestion of the cerebral vessels. (‘Med. Times and Gaz.,’ 1871, i. p. 132.) A lady took, in three doses, at intervals of four hours, seventy grains of chloral. In two hours after the last dose, she suffered from severe cramps in the legs, a feeling of suffocation, swimming in the head, and inability to regulate her movements. Four hours after the last dose, her face was flushed, the eyelids were closed, and the conjunctivæ injected; pulse 120 and bounding. She was with difficulty roused. She recovered in about sixteen hours. (‘Med. Times and Gaz.,’ 1870, ii. p. 435.) A man took thirty grains and became unconscious almost immediately after swallowing it—the face and hands turned livid and cold, and breathing took place only at long intervals; indeed, for about five hours death seemed to be impending. He recovered. (‘Lancet,’ 1870, ii. p. 102.) A dose of one hundred and sixty grains was given by mistake to a middle-aged man. He recovered. Another case of recovery after a similar dose has been reported. (‘Brit. Med. Jour.,’ 1878, ii. p. 437.) A lady swallowed, in the form of syrup, one hundred and sixty grains of hydrate of chloral at eight o'clock. About three or four hours afterwards she was seen in a state of unconsciousness, lying on her back: pulse 80, regular but small; respirations, 28 per minute; pupils moderately contracted, but not altogether insensible to light. She had vomited, and a frothy mucus oozed from her mouth. She was temporarily roused by ammonia. She could not swallow. The stomach-pump was used, and the stomach freely washed out. Coffee was given by the rectum. Electricity was employed for an hour and a half, when she recovered her consciousness, and stated what she had taken. She recovered.

N. Smith met with two instances in which sudden death followed ordinary doses, and in another case a drachm and a half thrown into the rectum produced insensibility and death. (‘Lancet,’ 1871, ii. p. 466.) It has been observed in reference to this drug, that, during the sleep produced by it, the pupil is contracted, but that it immediately dilates on the person awaking. In other cases, the pupil has been found dilated and insensible to light. These facts show that there is considerable uncertainty in the action of this drug, even when similar doses have been given. A slight overdose may cause sudden death by syncope ('Lancet,' 1873, i. p. 640); and ordinary doses long continued may seriously affect mind and body. ('Lancet,' 1873, i. p. 789.) After an ordinary dose of twenty or thirty grains, a patient has slept for a quarter of an hour, and has then awakened with a sense of deadly faintness, the lips livid, the face pale, the pulse scarcely perceptible, and a feeling of intense exhaustion and impending dissolution, mingled with delirium, lasting for five or ten minutes. It appears to exert a depressing action on the heart, and in cases of heart-disease it may thus cause sudden death. ('Lancet,' 1871, ii. p. 32.) One case proved suddenly fatal by causing paralysis of the heart. ('Lancet,' 1871, i. pp. 227, 440–473.) (For the effects of chronic poisoning by this substance, see 'Lancet,' 1873, i. p. 695.)

From the facts hitherto reported, it is difficult to assign a minimum fatal dose. A dose of *thirty grains* proved fatal in thirty-five hours to a young lady aged twenty, while there have been two cases of recovery in which doses of one hundred and sixty grains were taken, and one in which a man recovered after taking one hundred and eighty grains dissolved in syrup. ('Brit. Med. Jour.,' 1875, p. 778.) Recovery in these cases was no doubt greatly owing to treatment. The editor met with a case in which a young man barely survived a dose of seventy grains; he became idiotic, and never entirely recovered. A patient may die in a few minutes, but more commonly survives for a few hours. Death has ensued so late as ten and even thirty-five hours.

Analysis.—The hydrate of chloral is a white, crystalline solid, of a peculiar lemon-like odour, and has a pungent bitter taste. When heated on platinum, it melts and is entirely volatilized without combustion. It is not inflammable. Heated in a close tube it melts and does not rapidly solidify. It is distilled over in a liquid form, and after a time it sets into groups of crystals in the glass tube. It is very soluble in water. The solution is not acid, has no bleaching properties, and gives only a faint milkiness on boiling with a solution of nitrate of silver. It is dissolved by strong sulphuric and nitric acids without any change of colour. Potash and ammonia added to the solution convert it instantly into chloroform, which escapes in copious effervescence, and may be recognized by its peculiar odour. It is by this conversion that hydrate of chloral may be detected in the contents of the stomach. One hundred parts will yield seventy-two parts of chloroform. The liquid should be rendered alkaline with potash, and the mixture heated in a flask by a water-bath. The vapour which escapes may be tested for chloroform by the process described at p. 185. Procter thus detected it in a case of suicidal poisoning.

The quantity of hydrate of chloral present in a stong solution, *e.g.* a draught, may be approximately determined by placing a measured quantity of the solution in a graduated and stoppered burette, and shaking with a solution of soda. On allowing the mixture to stand, the chloroform formed by the decomposition of the hydrate of chloral will form a dense layer at the bottom. Approximately each minim of chloroform separated represents two grains of hydrate of chloral. By adding a solution of soda of known strength to a definite volume of a solution of chloral, and, when the chloral is decomposed, titrating the uncombined soda, the percentage of hydrate of chloral in a dilute solution may be determined with considerable accuracy.

Camphor.

Symptoms and Appearances.—Camphor operates on the brain and nervous system. In one case, a woman swallowed in the morning about *twenty grains* dissolved in rectified spirits of wine, and mixed with tincture of myrrh. In half an hour she was suddenly seized with langour, giddiness, occasional loss of sight, delirium, numbness, tingling and coldness of the extremities, so that she could hardly walk. The pulse was quick, and respiration difficult; but she suffered no pain in any part. On the administration of an emetic, she vomited a yellowish liquid smelling strongly of camphor. In the evening the symptoms were much diminished, but she had slight convulsive fits during the night. The next day she was convalescent; the difficulty of breathing, however, continued more or less for several weeks. This is the smallest dose of camphor which appears to have been attended with serious symptoms in an adult. Camphor has proved fatal to infants and children, the symptoms being chiefly vomiting and purging, with violent convulsions.

A case of poisoning by camphor would be recognized by the odour of the breath, a symptom which would attract the attention of a non-professional person. The presence of this substance in the stomach would be at once indicated by its odour.

CHAPTER 19.

TOBACCO (NICOTIANA TABACUM). NICOTINE.—COCCULUS INDICUS.—PICROTOXIN.—CALABAR BEAN.—MUSHROOMS.

Tobacco (Nicotiana tabacum). Nicotine.

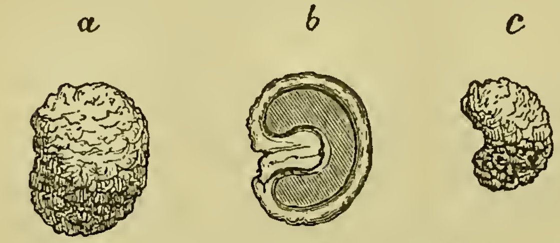
Symptoms.—The effects which tobacco produces, when taken in a large dose, either in the form of powder or infusion, are well marked. The symptoms are faintness, nausea, vomiting, giddiness, delirium, loss of power in the limbs, general relaxation of the muscular system, trembling, complete prostration of strength, coldness of the surface, cold clammy perspiration, convulsive movements, paralysis, and death. In some cases there is purging, with violent pain in the abdomen; in others there is rather a sense of sinking or depression in the region of the heart, passing into syncope, or creating a feeling of impending dissolution. With the above-mentioned symptoms there is dilatation of the pupils with insensibility to light, dimness of sight with confusion of ideas, a small, weak, and scarcely perceptible pulse, difficulty of breathing, and involuntary discharge of urine. Tobacco owes its poisonous properties to the presence of a volatile alkaloid, *nicotine.*

Nicotine.—This is a liquid alkaloid, a deadly poison, and, like prussic acid, it destroys life in small doses with great rapidity. It has the powerful odour of tobacco. It is volatile, and may be procured by distillation. The author found that a rabbit was killed by a single drop in three minutes and a half. ('Guy's Hosp. Rep.,' 1858, p. 355.) A celebrated case of poisoning by this alkaloid which occurred in Belgium in 1851, was the subject of a trial for murder—case of the *Count Bocarmé.* ('Ann. d'Hyg.,' 1851, vol. 2, pp. 147, 167.) In another, which proved fatal in from three to five minutes, the appearances observed were a general relaxation of the muscles, prominent and staring eyes, bloated features, great fulness with lividity about the skin of the neck. There was no odour resembling nicotine or tobacco perceptible about the body. When the body was examined between two and three days after death, putrefaction had occurred. The swelling of the neck was found to arise from an effusion of dark liquid blood, especially in the course of the veins. The scalp and the membranes of the brain were filled with dark-coloured blood. The lungs were engorged, and of a dark purple colour. The cavities of the heart were empty, with the exception of the left auricle, which contained two drachms of dark-coloured blood. The stomach contained a chocolate-coloured fluid, in which nicotine was detected: the mucous membrane was of a dark crimson-red colour from the most intense congestion. There was no odour excepting that of putrefaction. The liver was congested and of a purplish-black colour. The blood throughout the body was black and liquid, but in some parts it had the consistency of treacle. ('Guy's Hosp. Rep.,' 1858, p. 354.) The insidious nature of this poison is proved by the fact that, in 1877, a child, æt. 3, died from using an old wooden pipe, for blowing soap-bubbles. It had been used by his father for smoking, but had been put by for a year. He had washed it before giving it to his son. The child was quite well at the time, but in an hour he was seized with drowsiness and sickness, and died with the symptoms of narcotic poisoning. He had imbibed sufficient nicotine from the pipe to destroy life.

LEVANT NUT (COCCULUS INDICUS).

Symptoms and Effects.—This is the fruit or berry of the ANAMIRTA COCCULUS (*Levant Nut*), imported from the East Indies. The berry contains from one to two per cent. of a poisonous bitter substance (*Picrotoxin*). The shell or husk contains no picrotoxin, but a non-poisonous principle called *Menispermin* (see Fig. 22, p. 190). The seeds, in powder or decoction, give rise to nausea, vomiting, and griping pains, followed by stupor and intoxication. There are only two well-authenticated instances of this substance having proved fatal to man. Several men suffered from this poison in 1829, near Liverpool: each had a glass of rum strongly impregnated with Cocculus indicus. One died that evening; the rest recovered. (Traill's 'Outlines,' 146.) Of the second case, the following details have been published: A boy, æt. 12, was persuaded by his companions to swallow forty grains of a composition used for poisoning fish. It contained Cocculus indicus. In a few minutes he perceived an unpleasant taste, with burning pain in the gullet and stomach, not relieved by frequent vomiting—as well as pain extending over the whole of the abdomen. In spite of treatment, a violent attack of gastro-enteritis supervened, and there was much febrile excitement, followed by delirium and purging, under which the patient sank on the nineteenth day after taking the poison. On inspection, the vessels of the pia mater were congested with dark-coloured liquid blood. There was serous effusion in the ventricles of the brain, and the right lung was congested. In the abdomen there were all the marks of advanced peritonitis. The stomach was discoloured, and its coats were thinner and softer than natural. (Canstatt's 'Jahresbericht,' 1844, 5, 298.) Porter, ale, and beer owe their intoxicating properties in some instances to a decoction, or extract, of these berries. (For some remarks on this adulteration of beer and other liquids, and a process for separating the poisonous principle, *picrotoxin*, by amylic alcohol, see 'Chem. News,' March 12, 1864, p. 123.) Cocculus indicus operates readily as a poison on animals, and it has thus been frequently used for the malicious destruction of fish and game. In one instance referred to the author, there was reason to believe that 270 young pheasants had been poisoned by grain soaked in a decoction of this substance. *Barber's poisoned wheat* for the destruction of birds owes its poisonous properties to Cocculus indicus. (Horsley.) (See 'On Poisons,' 3rd edit., p. 679.)

Fig. 22.



a, Berry of Cocculus Indicus, natural size.
b, The same, seen in section with one-half of the semi-lunar kernel.
c, The kernel, containing picrotoxin.

Calabar Bean (Physostigma venenosum).

The Calabar bean is a large leguminous seed of a dark colour, resembling a garden bean, but much thicker and more rounded in its form. It is brought from the western coast of Africa, and is there employed by the natives as an ordeal bean when persons are suspected of witchcraft. This bean owes its properties to the presence of an alkaloidal substance called *Physostigmine*, or *Eserine*.

Desiring to try the effects of this seed on himself, Christison took the eighth part of a seed, or six grains, one night before going to bed.

There was slight sense of numbness of the limbs during the night, but in the morning no urgent symptoms of any kind. He then chewed and swallowed the fourth part of a seed (twelve grains). In twenty minutes he was seized with giddiness, and a general feeling of torpor over the whole frame. He immediately swallowed an emetic, and thus emptied his stomach. The giddiness, weakness, and faintness increased to such a degree that he was obliged to lie down in bed. In this state he was seen by two medical friends, who found him prostrate and pale, the heart and pulse extremely feeble and tumultuously irregular, the mental faculties intact, with extreme faintness threatening dissolution, but no apprehension of death on the part of the patient. There was no uneasy feeling of any kind, no pains or numbness, no prickling, not even any sense of suffering from the great feebleness of the heart's action. There was the will, but not the power to vomit; the limbs became chill, with a vague feeling of discomfort. Stimulants were employed; and warmth and pulsation, with a power of moving, gradually returned. Two hours after the poison had been taken he felt drowsy, and slept for two hours more; but with such activity of mind that he had no consciousness of having been asleep. The tumultuous action of the heart continued. After this the symptoms gradually disappeared, and the next day he was quite well. ('Pharm. Jour.,' 1855, p. 474.)

In 1864, fifty children were poisoned at Liverpool by reason of their having eaten these beans. The sweepings of a ship from the west coast of Africa had been thrown on a heap of rubbish; the children found the beans and ate them. A boy, æt. 6, who ate six beans, died in a very short time. The principal symptoms were severe griping pains, constant vomiting, and contracted pupils. In addition to these symptoms, the face was pale, and the eyes were bright and protruding. In attempting to walk the children staggered about as if they were drunk. In 1864, two children, aged six and three years respectively, ate the broken fragments of the kernel of one nut. In about forty minutes they complained of sickness. One child held his head drooping, appeared sleepy, and his hands were powerless. He staggered and was scarcely able to walk. He complained of severe pain in the stomach, and made ineffectual attempts to vomit. Milk was given, and he then vomited. The child became quite prostrated; the pulse was feeble and slow, and the pupils were slightly contracted. Some pieces of the nut were thrown up by vomiting. The other child had pain in the abdomen, and was listless, sleepy, and depressed. He vomited freely, some portions of nut being ejected. He could neither stand nor walk. His face was pale, the eyes were piercing, but the pupils and pulse were natural. In this case there was purging. The children recovered on the third day. ('Edin. Month. Jour.,' 1864, p. 193.) In cases in which it has proved fatal to animals it has caused much irritation and congestion of the stomach and bowels. (Dragendorff.) Fraser relates the case of two maidservants who were poisoned by tasting some of the embryos of the bean through curiosity. ('Edin. Med. Jour.,' 1863, 2, p. 131.)

The editor has himself noticed a very marked diminution of respiratory depth from the hypodermic use of salts of physostigmine (eserine), the active alkaloid of the bean.

Poisonous Mushrooms (Fungi).

No branch of toxicology has given rise to greater differences of opinion than the study of poisoning by fungi. Some authors have considered nearly every kind of mushroom as unfit for food; whilst others, again, seem to regard nearly every species as edible with safety. In inquiring into the causes of these discrepancies of opinion, it will be found that, whilst some species of fungi are undoubtedly to be regarded as poisonous, since they contain an integral poisonous constituent or constituents which may be isolated in a greater or less state of purity, others produce injurious effects only under certain conditions, such as idiosyncrasy of the individual, decomposition of the fungus, &c. The morel and *Hevella esculenta* are highly esteemed kinds of mushrooms, and yet Keber relates the history of six persons who, after partaking of these fungi, were attacked with vomiting and diarrhœa which lasted for sixty hours. ('Preussische Vereinzeitung,' 1846, No. 32. See also 'Arch. f. Exp. Path. v. Pharm.,' 1885, xix. p. 403; 'Med. Chron.,' iii. p. 219.) Poisonings by the common edible mushroom (*Agaricus campestris*) are rare, except when the mushrooms are decayed.

Symptoms and Effects.—The noxious species of mushrooms act sometimes as narcotics, and on other occasions as irritants. It would appear from the reports of several cases, that when the narcotic symptoms are excited, they come on soon after the meal at which the mushrooms have been eaten, and they are chiefly manifested by drowsiness, giddiness, dimness of sight, and debility. The person appears as if intoxicated, and there are sometimes singular illusions of sense. The pupils are dilated. Spasms and convulsions have been occasionally witnessed among the symptoms, chiefly in fatal cases. In some instances these have been of a tetanic character, with great difficulty of breathing. ('Brit. Med. Jour.,' ii. 1874, p. 464.) When the drowsiness passes off, there is generally nausea and vomiting; but sometimes vomiting and purging precede the stupor. If the symptoms do not occur until many hours after the meal, they partake more of the characters of irritation, indicated by pain and swelling of the abdomen, vomiting, and purging. In a case of poisoning by mushrooms, there was slight vomiting about an hour and a half after the meal, but no violent symptoms until after the lapse of ten hours. Several cases in which the symptoms did not appear for fourteen hours are reported. ('Med. Gaz.,' vol. 25, p. 110.) In some instances the symptoms of poisoning have not commenced until thirty hours after the meal; and in these, narcotism followed the symptoms of irritation. It might be supposed that these variable effects were due to different properties in the mushrooms; but the same fungi have acted on members of the same family, in one case like irritants, and in another like narcotics. In most cases recovery takes place, especially if there is early vomiting. In the instances which have proved fatal, there has been greater or less inflammation of the stomach and bowels, with congestion of the vessels of the brain. ('Med. Gaz.,' vol. 46, p. 307; vol. 47, p. 673; and 'Jour. de Chim. Méd.,' 1853, p. 694.)

Poisoning with mushrooms is usually the result of accident or mistake. They are not taken for the purpose of suicide, and the author has met with only one instance in which it was alleged they were intentionally given to destroy life. In Aug. 1873, a gardener in the metropolitan district was committed on a charge of murder for causing the death of a young woman by giving her poisonous mushrooms. The accused, it was alleged, had a motive for the act, but he denied that he knew the mushrooms to be poisonous. The deceased fried them, and had some for breakfast. She suffered severe pain, and died the same evening. Other persons who partook of them were also taken ill, but recovered.

This form of homicide would be very difficult to establish. It would be necessary to show that the mushrooms were really poisonous, and to the knowledge of the accused. None might be forthcoming, so that there would be no botanical evidence of their poisonous nature. But as persons have died from taking edible mushrooms (see case, *infra*), it might be alleged that there was nothing criminal in the act, and that the death was owing to idiosyncrasy.

In the 'Guy's Hosp. Rep.,' 1865, p. 382, are recorded two fatal cases—in a mother and daughter, who died from the effects of the *Amanita citrina*, a yellow-coloured fungus, gathered in mistake for mushrooms. The woman fried the fungi, and they were eaten for supper. No symptoms appeared for seven hours. The child, when seen by a medical man, was feverish and thirsty, and the pupils were strongly dilated. There was severe pain in the stomach, and a sense of constriction in the throat. The child became convulsed and insensible, and died forty-one hours after eating the fungi. The mother and another child suffered from similar symptoms; the mother partially recovered, but had a relapse, and died on the fifth day. No inspection of the bodies was made.

One fatal case of poisoning by fungi was attended with symptoms of irritation resembling those caused by arsenic. There was no loss of consciousness or sensibility. A boy, æt. 13, fried and ate for breakfast at 8.30 a.m. two fungi which he had found growing under a tree. He returned to his work without any complaint. At noon he had his dinner of pork and vegetables. At 1 p.m. he returned to work, where he remained until 6 p.m., working the whole time without any complaint. Soon after he reached home he complained of feeling ill, and vomited violently. Purging then followed, with severe spasmodic pain in the abdomen. These symptoms continued throughout the night until 6 a.m.; the bowels then ceased to act. At 11.30 a.m. he was suffering from constant pain in the bowels, occasionally aggravated; there was tenderness over the abdomen generally, but especially over the course of the transverse colon, with vomiting every ten minutes, great thirst, warm perspiring skin, pulse 90, and great depression.

At 3 a.m. on the second day he was again seen. Vomiting and purging had returned. There was great exhaustion, pulse imperceptible, the action of the heart feeble. He was lying in bed on his back, with the knees drawn up. Sensibility and consciousness were perfect. He complained of great pain in the stomach; there was tenderness over the abdomen, but no swelling of the cavity. In another hour he died, *i.e.* about forty-four hours after eating the fungi, and about thirty-four after the first setting in of the symptoms. Others partook of the fungi, but in small quantity, and they did not suffer. On inspection, the heart on the right side contained a little fluid blood. The left ventricle was contracted and empty. The lungs were healthy, and there was only cadaveric congestion. The lining membrane of the stomach and small intestines was throughout injected; the bluish-red appearance diminishing in intensity as it approached the cæcum. There were a few ecchymosed patches near the intestinal end of the stomach. The organ contained six ounces of a brownish liquid, resembling thin gruel. The large intestines were empty and pale, and the spleen was congested; the other organs were healthy. ('Med. Times and Gaz.,' 1863, 2, p. 536.) In many of its features, and in the absence of narcotic symptoms, this case resembled a case of acute poisoning by arsenic; the fact that nearly ten hours elapsed before the symptoms of irritation commenced, and that there was no blood in the matters discharged by vomiting and purging, were the most marked differences.

In 1871, two children died from the effects produced by noxious fungi. Several other persons were placed in a precarious condition from the same cause. Some fowls died from eating portions of the mushrooms. Two children, a boy, æt. 8, and a girl, æt. 10, cooked some mushrooms for breakfast. The boy ate greedily of them, but permitted the girl to take only one mushroom. The symptoms produced in both children were similar, except that the boy had them in a severer and fatal form, and the girl recovered. Three or four hours after the meal the girl was seized with violent pains in the head and abdomen; she vomited several times in the course of the day, was restless, thirsty, and had occasional muscular twitchings of the hands. During the night the symptoms increased in severity, and she slept but little. Next day there was slight diarrhœa. When admitted into hospital, fifty-four hours after the mushrooms were eaten, all the symptoms had nearly subsided. The boy was then collapsed, and died twenty minutes afterwards. His stomach was found empty and contracted; its mucous coat pink, with minute injection, and covered with a thick layer of dryish epithelium. The liver was fatty. ('Guy's Hosp. Rep.,' 1872, p. 228.) Cases of poisoning by fungi are reported in Husemann's 'Jahresbericht,' 1872, p. 534.

A man, æt. 43, and his daughter, æt. 5, suffered severely from eating the *Amanita pantherina*. The earliest symptoms appeared in two hours and a half after the meal. They were thirst, faintness, delirium, nausea, paleness of the face, and cold extremities. After eleven hours there was stupor, with tenderness of the abdomen. In the child there was cyanosis of the legs, with contracted pupils. It was remarked that, even fourteen hours after the fungi had been eaten, portions of them were discharged by vomiting from the action of emetics. Both recovered. In a period of four years (1865–8), six deaths were recorded to have taken place from eating poisonous fungi. In the year 1880 no case of poisoning by mushrooms was recorded in England. An analysis of cases of mushroom-poisoning shows that when the symptoms are referable to the presumably decayed state of the fungi, these produce violent gastro-intestinal symptoms; and that, as a rule, these symptoms appear only after the lapse of some hours, and then the course of the case is not unlike one of cholera. The fly-fungus (*Amanita muscaria*) contains a definite alkaloid (*Muscarine*), and when this fungus is eaten, generally in mistake for the golden mushroom (*Amanita Cæsarea*), the symptoms appear within half an hour or an hour, though occasionally at a much later period; and they are of a cerebral character—the gastro-intestinal symptoms being either only secondary or altogether absent. Thus there is a state of excitement and inebriation, trismus, etc. Ponfick has recently made the extraordinary statement that an infusion of the ordinary mushroom is poisonous. This is contrary to common experience; and the children of rural districts often eat with impunity large quantities of uncooked mushrooms.

Analysis.—The discovery of portions of the undigested mushrooms in the matter vomited, or a description of the food eaten, will commonly lead to a recognition of this form of poisoning. One of the most poisonous fungi, *Amanita muscaria*, or the fly-mushroom, renders the water in which it has been boiled so poisonous that animals are killed by it, while the boiled fungus is itself inert. The liquid procured from it is used as a fly-poison, whence the name of the fungus. It is an autumnal fungus of a rich orange-red colour, and owes its deadly properties to an alkaloid (*Muscarine*).

These fungi can be recognized only by their special botanical characters. Berkeley says, ‘No general rule can be given for the determination of the question whether fungi are or are not poisonous. Colour is quite indecisive, and some of the most dangerous fungi, and amongst them the *Agaricus phalloides*, are void of any unpleasant smell when fresh, though the most wholesome may be extremely offensive when old. Experience is the only safe test, and no one should try species incautiously with whose character he is not thoroughly acquainted.’ Portions of the fungi may be found in the food or in the contents of the stomach, but if there has been vomiting and purging, it is probable that the whole of the substance will be expelled. Fungi contain but little solid matter.

Much has been said and written on the methods of distinguishing the edible from the noxious fungi, but instances have occurred in which the former have produced symptoms of poisoning and have destroyed life. A case in which a woman died in twenty hours from eating ordinary mushrooms was communicated to the author by Smith, of Shepton Mallet, in Aug. 1873. The symptoms resembled those above described.

CHAPTER 20.

HENBANE.—ATROPA BELLADONNA, OR DEADLY NIGHTSHADE.—POISONING BY ATROPINE.—DATURA STRAMONIUM, OR THORN-APPLE.

HENBANE (HYOSCYAMUS NIGER).

Symptoms and Appearances.—The seeds (Fig. 23), roots, and leaves of this plant are poisonous. When the dose is not sufficient to destroy life, the symptoms are—general excitement, fulness of the pulse, flushing of the face, weight in the head, giddiness, loss of power and tremulous motion of the limbs, somnolency, dilatation of the pupils, double vision, nausea, and vomiting. After a time these symptoms pass off, leaving the patient merely languid. When a large quantity of the *root* or *leaves* has been eaten—an accident which has occurred from the plant having been mistaken for other vegetables—more serious effects are manifested. In addition to the above symptoms in an aggravated form, there will be loss or incoherency of speech, delirium, confusion of thought, insensibility, coma, and, sometimes, a state resembling insanity; the pupils are dilated and insensible to light; there is coldness of the surface; cold perspiration; loss of power in the legs, alternating with tetanic rigidity and convulsive movements of the muscles; the pulse small, frequent, and irregular; the respiration deep and laborious. ('Med. Gaz.,' vol. 47, p. 640.) Occasionally there is nausea, with vomiting and purging. Death may take place in a few hours or days, according to the severity of the symptoms.

Fig: 23.

Seeds of Henbane.
a, Natural size.
b, Magnified 30 diameters.

The special effect of this poisonous plant is manifested in its tendency to produce a general paralysis of the nervous system. According to White, the biennial is more powerful than the annual plant. He reports the case of a woman, æt. 34, who swallowed, by mistake for a black draught, an ounce and a half of tincture of hyoscyamus. Symptoms came on in ten minutes, the most marked among them being a complete loss of power to move her legs; insensibility and delirium followed; and it was six days before she began to recover. She entirely lost her memory. ('Lancet,' 1873, i. p. 8.)

The poisonous properties of henbane are due to the presence of two alkaloids (*Hyoscyamine* and *Hyoscine*). These, with atropine, the active alkaloid of belladonna, are perhaps the only three known natural vegetable alkaloids that cause excessive dilatation of the pupil of the eye.

DEADLY NIGHTSHADE (ATROPA BELLADONNA). ATROPINE.

Symptoms.—The symptoms which are produced by the leaves, berries, seeds, and root of belladonna are of a uniform character, and, as a summary, they may be thus described: heat and dryness of the mouth and throat, nausea, vomiting, giddiness, indistinct or double vision, delirium, great excitement, and convulsions followed by stupor and lethargy. The pupils are much dilated, and the eyes are insensible to light. In two cases which occurred to Tufnell, the pupils were contracted during sleep, although dilated in the waking state. ('Dublin Med. Press,' Jan. 5, 1853; 'Jour. de Chim. Méd.,' 1853, p. 695.) A woman took by mistake an ounce of belladonna liniment instead of her medicine, and in about twenty minutes had passed into a state of insensibility. Copious draughts of mustard and water, and salt and water, were administered without provoking vomiting. She was in a state of coma; the extremities were warm; the abdomen was slightly hard; breathing was regular; pulse 70, fairly good. There was inability to swallow; the pupils were natural, but not sensitive to strong light. Three hours later her condition was not much changed: the coma was not so complete; there was some struggling; there was incontinence of urine; the pupils were unaltered. One-fourth of a grain of morphine was injected subcutaneously. Eight hours later, coma had passed off, and was succeeded by delirium. Subsultus tendinum was present; she could swallow freely. The next day all the symptoms had disappeared excepting some dryness of the mouth and throat. It is noticeable that throughout the pupils were unaffected. ('Brit. Med. Jour.,' 1885, i. p. 377.)

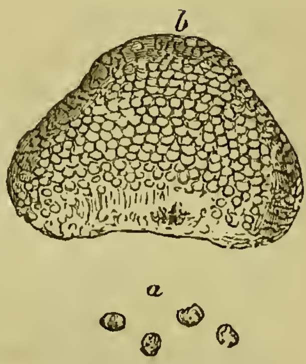
Several deaths from the poisonous effects of the *berries* occurred in 1846. The following case was admitted into Guy's Hospital:—A boy, æt. 14, ate, soon after breakfast, about thirty of the berries of the belladonna. In about three hours he had the sensation of his face being swollen; the throat became hot and dry, the vision was impaired, objects appeared double, and they seemed to revolve and run backwards. His hands and face were flushed, and the eyelids swollen; there were occasional flashes of light before his eyes. He tried to eat, but could not swallow on account of the state of his throat. In endeavouring to walk home he stumbled and staggered; and he felt giddy whenever he attempted to raise his head. His parents thought him intoxicated: he was incoherent, frequently counted his money, and did not know the silver from the copper coins. His eyes had a fixed, brilliant, and dazzling gaze; he could neither hear nor speak plainly, and there was great thirst; he caught at imaginary objects in the air, and seemed to have lost all knowledge of distance. His fingers were in constant motion; there was headache, but neither vomiting nor purging. He did not reach the hospital until nine hours had elapsed; and the symptoms were much the same as those above described. He attempted to get out of bed with a reeling, drunken motion; his speech was thick and indistinct. The pupils were so strongly dilated that there was merely a ring of iris visible, and the eyes were quite insensible to light. The eyelids did not close when the hand was passed suddenly before them. He had evidently lost the power of vision, although he stared fixedly at objects as if he saw them. The nerves of common sensation were unaffected. When placed on his legs he could not stand. His pulse was 90, feeble and compressible; his mouth was in constant motion, as if he were eating something. His bladder was full of urine on admission. He continued in this state for two days, being occasionally conscious, when by a free evacuation of the bowels, some small seeds were passed; these were examined and identified as the seeds of belladonna. The boy gradually recovered, and left the hospital on the sixth day after his admission. The progress of recovery was indicated by the state of the pupils, which had only then acquired their natural size and power of contraction. In three other cases which occurred at the same time, the berries having been baked in a pie, pains in the limbs, drowsiness, insensibility, and convulsions were among the symptoms. In two instances of poisoning by the berries, related by Moll, the symptoms bore a strong resemblance to those of delirium tremens, but among them were some peculiar to the action of belladonna, namely, heat and dryness of the throat, loss of power of swallowing, incoherent speech, double vision, and strange spectral illusions, with occasional fits of wild and ungovernable laughter. On the following morning both these patients recovered as if from a dream; but they suffered for some time from languor, thirst, and dryness of the throat; the pupils also continued dilated. (Casper's 'Wochenschrift,' 1846, p. 26.) Two cases, showing the poisonous effects of the berries on children, are quoted in the 'Edin. Med. and Surg. Jour.,' vol. 29, p. 452. The following case, which occurred in Nov. 1871, is remarkable for the fact that a woman recovered from a large dose of the extract. A nurse gave by mistake to a lady whom she was attending a belladonna liniment containing three drachms of the extract mixed with soap liniment. She vomited slightly, suffered from dryness of the throat, difficulty of swallowing, drowsiness, delirium, dilated pupils, fixed staring of the eyes, loss of power and difficulty of speech. Paralysis of the extremities came on, with great pain in the back. Emetics, with brandy and cayenne pepper, were employed with success. The woman recovered, but not until after five weeks from the time of swallowing the liniment. A child, nearly four years old, swallowed only two or three drops of a liniment containing belladonna. The child went to sleep for an hour, when it was seized with tremblings and convulsions, dilated pupils, delirium, and other symptoms of belladonna-poisoning. It recovered only after three days, this being indicated among other signs by the normal state of the pupils. ('Guy's Hosp. Gaz.,' June, 1878.) In another case, in which a lady swallowed four ounces of belladonna liniment, in addition to the usual symptoms speech was lost. There was complete paralysis of the legs, and a diffused scarlet rash appeared on the neck and the upper part of the chest. She fell into a state of somnambulism, and, on her recovery in three or four days, her life appeared to be a complete blank. ('Brit. Med. Jour.,' 1876, ii. p. 678.) Such cases are common.

This poison readily acts through the unbroken skin. In one case equal parts of mercurial ointment and extract of belladonna were applied to the scrotum of a man. On the second day all the symptoms of poisoning came on, with flushed face and pupils dilated and insensible to light. ('Brit. Med. Jour.,' 1877, ii. p. 164.) The editor has seen cases of severe poisoning resulting from the application of atropine ointment to ulcers.

Appearances.—The appearances observed in several fatal cases of poisoning with the berries in London, during the autumn of 1846, were as follows: the vessels of the brain were congested with liquid blood; the stomach and intestines were pale and flaccid; there were some red spots towards the cardiac end. In other fatal cases, of which the appearances have been reported, the vessels of the brain and its membranes were found distended with thick black blood. Red spots have also been observed around the throat and gullet, and congested patches of a dark purple colour on the coats of the stomach. In some instances the mucous membrane has been completely dyed by the juice of the berries. A boy, æt. 5, after having eaten a quantity of the berries of the belladonna, went to bed, was very restless, vomited once, and died in convulsions about fifteen hours after having taken the poison. On inspection, the eyes were half-open, with an intense lustre; the pupils dilated; the mouth was spasmodically closed, and the sphincter ani relaxed. The cerebral vessels were distended with dark-coloured blood; the substance of the brain, cerebellum, and medulla oblongata presented numerous bloody points. In the throat and gullet there were several patches of redness. In the stomach there was some fluid, with three open berries; the mucous membrane was of a reddish-blue colour in various parts. (Canstatt's 'Jahresb.,' 1854, p. 295.)

Analysis.—The indigestible nature of the leaves, fruit, and seeds will commonly lead to their detention in the matters vomited or passed by the bowels, or in the contents of the viscera after death. The seeds of belladonna are very small, and can be distinguished by the microscope from the seeds of other poisonous plants. They are of a somewhat oval shape and of a dark colour. Under a low magnifying power they present a honeycombed surface (Fig. 24). In henbane the surface of the seeds presents more irregular depressions, resembling those seen on certain corals or madrepores. The colouring matter of the berry is of a deep purple hue; it is turned green by alkalies, and red by acids. The leaves would be known by their botanical characters, and a decoction or infusion of them by the liquid causing dilatation of the pupil.

Fig. 24.



Seeds of Belladonna.
a, Natural size.
b, Magnified 30 diameters.

Atropine.—Atropine is the name given to the active alkaloid of belladonna; it is a powerful poison. Symptoms of poisoning have been produced by the application of a weak solution of atropine to the eyes. Bowles found that about 1-60th of a grain repeated twice in half an hour, making 1-30th of a grain, dropped into the eye, produced in two adults, after some hours, loss of vision, giddiness, soreness of the throat, loss of power of swallowing, and widely dilated pupils. The latter symptom remained for eight days. ('Brit. Med. Jour.,' 1876, i. p. 533.) One-eighth of a grain injected beneath the skin for the relief of sciatica caused all the symptoms of poisoning with belladonna. ('Pharm. Jour.,' May, 1862, p. 583.) One grain used endermically nearly proved fatal at Guy's Hospital; and in the following case ('Med. Times and Gaz.,' 1865, ii. p. 34) a man who swallowed, by mistake, a grain of sulphate of atropine in solution, had a narrow escape with his life. In an hour afterwards, the following symptoms were observed: the pupils were enormously dilated, so that the irides were scarcely visible; the eyes moved restlessly from side to side. The pulse was very quick, and the patient appeared as if intoxicated. In another hour his hands were cold, the pulse weak, and there was loss of power in the limbs. He became restless, incoherent, and unconscious of preceding events. There was also delirium. In a later stage there was morbid sensitiveness to sounds and objects; the tongue was furred and the skin dry and hot. The pupils continued dilated for a week, and for several days there was a partial paralysis of the bladder. He recovered in a fortnight.

A fatal case of poisoning by sulphate of atropine is recorded by Greenway. A man, æt. 45, swallowed by mistake a teaspoonful of solution of sulphate of atropine equal to half a grain of the sulphate. The usual symptoms of poisoning followed, but it is remarkable that the patient did not die until the sixth day. ('Brit. Med. Jour.,' 1878, ii. p. 516.) Cases of atropine-poisoning of a mild character are common in hospital practice, in consequence of atropine lotions, intended for the eye, being accidentally taken by children and others.

In 1880, a boy, æt. 12, was admitted to Guy's Hospital, who on the previous day had eaten some ripe belladonna berries whilst on a country excursion. On returning home he went to bed as usual, but awoke at 2 a.m. in much the same condition as on his admission at 5 a.m. He was then delirious, and in such violent convulsions that he was unable to sit still a moment. He talked most incoherently. He apparently could not swallow, as he put water in his mouth and spat it out again; the effort throwing him into severe convulsions. At 10 a.m. the delirium and convulsions still continued; there was a marked flushing on the legs and face, and the latter was somewhat swollen. The throat was red, and he showed aversion to water. The pupils were widely dilated. The delirium continued, with convulsions, all day and during the next night, though occasionally he spoke rationally. He was flushed, and appeared like a child in the early stage of a scarlatina rash. At noon—about forty-two hours after, as was supposed, the berries were eaten—one-third of a grain of morphine was injected hypodermically. The boy slept, and next day awoke well.

Analysis.—Atropine is a white crystalline substance, not very soluble in water, but easily dissolved by alcohol, ether, and diluted acids. It does not readily crystallize, but it forms crystallizable salts. In 1850, Sells forwarded to the author for examination, the stomach of a young man who had poisoned himself by taking *two grains* of atropine. He took the dose on going to bed. He was heard to snore heavily during the night, and was found dead about seven in the morning, lying on his right side, the surface livid, the limbs rigid and contracted, and with a little brown matter issuing from the mouth. The pupils were much dilated. The mucous membrane of the stomach presented a diffused redness, which might have arisen from some brandy which he had swallowed. No trace of the poison could be detected in the stomach or the contents.

Atropine may be detected in, and separated from, organic liquids by the process of Stas (see p. 208, *post*).

The only test usually employed is of a physiological nature, namely, the effect produced on the pupil by small quantities of liquid, or extract, containing traces of atropine. The pupil is largely dilated and the eye loses its sensibility to light. There is nothing conclusive in this result, unless there is also strong evidence from *symptoms* that belladonna has been actually taken or administered.

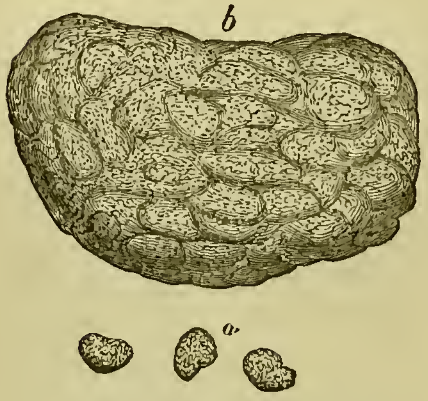
A medical man was charged with attempting to poison his wife and other persons with atropine, which it was alleged had been placed in a rabbit pie. (*Reg.* v. *Sprague,* Exeter Aut. Ass., 1865.) The evidence failed to show at the trial that the prisoner, or any other person, could have mixed poison with the pie, much less such a poison as this, which, in the dose of one or two grains, either destroys life or produces illness continuing for some time. The symptoms, as described, resembled those caused by noxious food, and differed in many respects from those of poisoning by atropine. The only fact on which this chemical theory seemed to rest was that the pupils of the eyes of those who ate of the pie and were taken ill were dilated, and a portion of the extract of the scrapings of the pie-dish is said to have caused a dilatation of the pupil of the analyst. ('Med. Times and Gaz.,' 1865, ii. p. 168; 'Chem. News,' Aug. 11, 1865, p. 72.) It is stated that the supposed poison was separated from the baked leg of a rabbit, by soaking it in dilute hydrochloric acid, but according to those who have examined the properties of atropine, this alkaloid melts at 194° F., is volatile at 284° F., and is then in great part decomposed. This is below an ordinary cooking temperature. The whole of the scientific theory rested upon the dilatation of the pupils, and this, although presumptive, is not positive evidence of atropine having been administered.

The criminal administration of atropine is a rare event in this country. A trial for murder by this alkaloid took place at the Manchester Lent Assizes, 1872 (*Reg.* v. *Steele*). The prisoner, who was a nurse in the workhouse, was charged with administering atropine to the senior surgeon, and thereby causing his death. The deceased was taken suddenly ill after his breakfast, and died under the usual symptoms of poisoning with atropine in about twelve hours. The poison, a solution of atropine in spirit, was detected in the body, and also in a liquid found in the room. Milk was the vehicle through which it was taken. The milk as sent from the kitchen contained nothing injurious, but that found in deceased's room was tasted by two of the nurses, and both suffered from poisoning by atropine. The prisoner had access to this room, and it was alleged that she had a strong motive for this criminal act, but there was no direct proof to show that she put the poison into the milk, and she was acquitted.

THORN-APPLE (DATURA STRAMONIUM).

Symptoms and Appearances.—The symptoms produced by stramonium, whether the leaves or seeds are used, are as follows: soon after the poison has been taken there is giddiness, dimness of sight, a sense of fainting, insensibility, fixed and dilated pupils, flushed countenance, and a slow, great, and full pulse. Sometimes there is restlessness, with a hot and red skin, a wild and staring countenance, the breathing hurried and gasping, incessant talking without distinct articulation; and there are attempts to drive away, or grasp at, imaginary objects. There is picking at the bedclothes, with paroxysms of excessive laughter, and, if the person can walk, it is with a staggering gait, and he falls to the ground as if intoxicated or completely exhausted. The seeds of two varieties of datura were used by the Thugs of India for rendering their victims powerless and insensible.

Fig. 25.



Seeds of Datura Stramonium.
a, Natural size.
b, Magnified 30 diameters.

Appearances.—In a well-marked case of poisoning with stramonium seeds, in which death took place in less than eight hours, the following appearances were found: great congestion of the vessels of the brain and its membranes, the brain firm and highly injected, the choroid plexus turgid, the ventricles contained serum, the substance of the lungs congested, and the heart flaccid. The stomach contained about four ounces of digested food mixed with eighty-nine seeds of stramonium. There were two patches of extravasation in the mucous coat—one on the larger curvature, and the other near the pylorus. Many seeds and fragments were also found in the intestines. ('Lancet,' 1847, ii. p. 298.) In another case there were marks of diffused inflammation about the cardiac end of the stomach.

Analysis.—The *seeds* of stramonium, from which accidents have most frequently occurred, are flattened, kidney-shaped, but half oval, rough, and of a dark-brown or black colour. They are liable to be mistaken for the seeds of capsicum. Of the dry *Datura stramonium* there are about eight seeds to a grain. They are of an oblong kidney-shape, and of a dark-brown or black colour. The illustration (Fig. 25) shows their appearance under a low power of the microscope. The leaves of the common Datura stramonium are well characterized by their peculiar shape.

CHAPTER 21.

NUX VOMICA.—STRYCHNINE.—SYMPTOMS AND APPEARANCES.—CHEMICAL AND MICROSCOPICAL ANALYSIS OF NUX VOMICA AND STRYCHNINE.—PROCESS FOR ORGANIC MIXTURES.—DIALYSIS.—BRUCINE.

Nux Vomica. Strychnine, or Strychnia.

Symptoms.—At a variable interval after taking either nux vomica or strychnine in a poisonous dose, the person experiences a sense of uneasiness and restlessness, accompanied by a feeling of impending suffocation. There is a shuddering or a trembling of the whole frame, with twitchings and jerkings of the arms and legs. Tetanic convulsions then commence suddenly with great violence, and nearly all the muscles of the body are simultaneously affected. The limbs are stretched out involuntarily, the hands are clenched; the head, after some convulsive jerkings, is bent backwards, and the whole of the body becomes as stiff as a board. As the convulsions increase in frequency and severity, the body assumes a bow-like form (opisthotonos), being arched in the back and resting on the head and heels. The head is firmly bent backwards, and the soles of the feet are incurvated or arched, or everted, the legs sometimes separated. The abdomen is hard and tense, and the chest spasmodically fixed, so that respiration appears to be arrested. The face assumes a dusky, livid, or congested appearance, with a drawn, wild, or anxious aspect; the eyeballs are prominent and staring, and the lips are livid. The intellect is clear, and the sufferings, during this violent spasm of the voluntary muscles, are severe. The patient in vain seeks for relief in gasping for air and requiring to be turned over, moved, or held. The muscles of the lower jaw, which are the first to be affected in tetanus from disease, are generally the last to be affected by this poison. The jaw is not always fixed during a paroxysm. The patient can frequently speak and swallow, and great thirst has been observed among the symptoms. In some cases of poisoning with nux vomica the jaw has been fixed by muscular spasm; but, unlike the lock-jaw of disease, this has come on suddenly in full intensity with tetanic spasms in other muscles, and there have been intermissions which are not usually witnessed in the tetanus of disease.

The sudden and universal convulsion affecting the voluntary muscles has sometimes been so violent that the patient has been jerked off the bed. After an interval of from half a minute to one or two minutes, the convulsions subside, there is an intermission, the patient feels exhausted, and is bathed in perspiration. It has been noticed in some of these cases that the pupils during the paroxysm are dilated, while in the intermission they are contracted. The pulse during the spasms is so quick that it can scarcely be counted. Slight causes, such as an attempt to move, a sudden noise, or gently touching the patient, will frequently bring on a recurrence of the convulsions. In cases likely to prove fatal, they rapidly succeed each other, and increase in severity and duration, until at length the patient dies, utterly exhausted. The tetanic symptoms produced by strychnine, when once clearly established, progress rapidly either to death or recovery. The person is conscious, and the mind is commonly clear to the last. He has a strong apprehension of death. The duration of the case, when the symptoms have set in, is reckoned by minutes, while in the tetanus of disease, when fatal, it is reckoned by hours, days, and even weeks. As a general statement of the course of these cases of poisoning, within two hours from the commencement of the symptoms the person either dies or recovers, according to the severity of the paroxysms and the strength of his constitution. Death sometimes takes place in a paroxysm. ('Lancet,' 1861, i. p. 572.) In poisoning with strychnine the temperature of the body is much increased. In 1885 (*Reg.* v. *Day,* Taunton Winter Ass.), a farmer was tried for the murder of a female relative by strychnine, but was acquitted, no *red* strychnine having been traced to the prisoner, although a red substance was deposed to as having been seen in the gruel, which was the vehicle in which the poison was administered. This is the only instance which the editor has met with of the criminal administration of strychnine as a *red* substance. (See Vermin-killers, p. 206, *post.*)

The *time at which the symptoms commence* appears from the recorded cases to be subject to great variation. In poisoning with nux vomica they are generally more slow in appearing than in poisoning with strychnine. Until they set in suddenly, the patient is capable of walking, talking, and going through his or her usual occupations. In a case which occurred to Pellarin, a man swallowed about 300 grains of nux vomica, and no symptoms appeared for two hours. He died speedily in a violent convulsive fit. ('Ann. d'Hyg.,' 1860, t. 2, p. 431.) Macredy reports a case of poisoning by a grain and a half of strychnine, followed by two fluid ounces of tincture of opium, where the symptoms of strychnine-poisoning did not manifest themselves till after the lapse of eight hours. The patient recovered. ('Edin. Med. and Surg. Jour.,' 1883, p. 757.) On an average in poisoning by strychnine the symptoms appear in from five to twenty minutes.

Appearances after Death.—In general the body is relaxed at the time of death, and stiffens afterwards; but the commencement and duration of the rigid state depend on various conditions. In some cases the body is found rigid and arched (opisthotonos), with incurvated toes. (*Reg.* v. *Day, supra.*) Among the *internal* appearances which have been met with in different cases, are congestion of the membranes and substance of the brain, as also of the upper part of the spinal marrow, with congestion of the lungs. The heart is contracted and empty; but its right cavities in some instances have been distended with liquid blood. The blood has been found black and liquid throughout the body. The mucous membrane of the stomach has occasionally presented slight patches of ecchymosis or congestion, probably depending on extraneous causes, such as the process of digestion, the presence of food or of alcoholic liquids. In most instances the stomach and intestines have been found quite healthy, and it is not in the nature of this poison either to inflame or to irritate the mucous membrane. Of the appearances observed in poisoning with strychnine, there are none which can be considered characteristic. Congestion of the membranes of the brain and spinal marrow is probably the most common.

Fatal Dose.—The sixteenth part of a grain of strychnine killed a child between two and three years of age in four hours. The smallest accurately recorded fatal dose in an adult was in the case of *Dr. Warner. Half a grain* of the sulphate of strychnine here destroyed life. ('On Poisoning by Strychnia,' pp. 138, 139.) So powerful are the effects of this drug in certain cases, that ordinary medicinal doses cannot be borne. The editor has known one-twelfth of a grain produce poisonous symptoms. Hare states that many deaths are recorded from one quarter to one-half a grain dose ('Boston Med. and Surg. Jour.,' Nov. 20, 1884, p. 482); but the editor has been unable to verify this statement. Symptoms of its poisonous action have frequently been unexpectedly produced. Fraser states that its action is most powerful through the skin. He found that when applied to rabbits hypodermically, from one-twentieth to one-fiftieth of a grain produced violent tetanic convulsions, followed by death in a few minutes.

With respect to *nux vomica*, three grains of the alcoholic extract have destroyed life. The smallest fatal dose of nux vomica in powder was in a case reported by Hoffmann, and quoted by Christison, also by Trail. *Thirty grains* of the powder, given in two doses of fifteen grains each, proved fatal. The poison was given by mistake for bark to a patient labouring under quartan fever. This is about equivalent to the weight of one full-sized seed, and to only one-third of a grain of strychnine in the two doses.

In fatal cases death generally takes place within two hours after the taking of strychnine. One of the most rapidly fatal cases recorded is that of *Dr. Warner*: the symptoms commenced in five minutes, and he died in *twenty minutes*. In the case of *J. P. Cook*, the symptoms commenced in an hour and a quarter, and terminated fatally in *twenty minutes*. In poisoning by nux vomica, death may occur within two hours. Christison mentions a case in which a man died in *fifteen minutes* after taking a dose. This is probably the shortest period known. The longest period at which death has occurred was six hours after administration of the poison. The editor met with a case where death occurred in five hours and a half. (C. C. C., *Reg.* v. *Barlow*, 1875; see 'Rep. of Trials for Murder by Poisoning,' by Browne and Stewart, p. 268.)

Vermin and Insect Killers.—Although it is difficult to procure strychnine at a druggist's shop, the poison is extensively sold to the public, in threepenny and sixpenny packets, under the name of Vermin-killers. *Butler's Vermin-killer* consists of a mixture of flour, soot, and strychnine. The author found the sixpenny packet to weigh about a drachm, and to contain from two to three grains of strychnine. As the poison is mechanically mixed with the other ingredients (flour and colouring matter), and is probably manufactured on a large scale, the proportion of strychnine is liable to variation. The threepenny packet contains about half that quantity of strychnine, but this is quite sufficient to destroy the life of an adult. In place of soot, Prussian blue is sometimes used as a colouring substance. The editor finds that there are two kinds of Butler's Vermin-killer in commerce: in one the poisonous ingredient is carbonate of barium, and in the other strychnine. A sixpenny packet of the latter weighed (1882) forty-two grains, and yielded two grains and a quarter of strychnine. Another sixpenny packet weighed sixty-two grains, and contained one grain and three quarters of strychnine. *Battle's Vermin-killer* is a powder similar to that of Butler's, containing a fatal proportion of strychnine as it is sold in packets. The editor found (1882) a threepenny packet of Battle's Vermin-killer to weigh twelve grains, and to contain one grain and a quarter of strychnine; and a sixpenny packet weighed twenty-five grains, and contained two grains and a half of strychnine. These powders are a fertile source of poisoning, either through accident or design; they are openly sold by ignorant people to others still more ignorant, and are much used for suicidal purposes. Artificial ultramarine has been sometimes improperly used instead of Prussian blue or indigo for colouring vermin-killers. A powder of this kind is prepared in Bristol. Since the colour of the powder is at once discharged by any acid (such as that of the gastric juice and ordinary articles of food), the recognition of such a powder may entirely fail. The editor has met with a red vermin-killer in commerce, containing 50 per cent. of strychnine, coloured with 4 per cent. of vermilion. *Red* strychnine—the crystals of the alkaloid superficially coloured by a secret trade process—is expressly made for the New South Wales market; and, in 1884, a quantity of this coloured strychnine found its way into English commerce.

Chemical Analysis.—*Nux vomica* is well known as a flat round kernel, about the size of a shilling, with radiating silken fibres, slightly raised in the centre. It is of a light-brown colour, and covered with fine silky fibres (see Figs. 26 and 27, p. 207). It is very hard, brittle, tough, and difficult to pulverize. The powder is of a grey-brown colour, like that of liquorice: it is sometimes met with in a coarsely rasped state; it has an intensely bitter taste. It yields to water and alcohol, strychnine, brucine, and some common vegetable substances. Heated on platinum-foil, it burns with a yellow smoky flame. Nitric acid turns it of a dark orange-red colour, which is destroyed by stannous chloride. These properties are sufficient to distinguish it from various medicinal powders which it resembles in colour; but the presence of any silky hairs or fibres revealed by the microscope (Fig. 28) would at once distinguish it from all other powders. They may be obtained from the contents of the stomach or any liquid article of food by washing and decantation. They are quite insoluble in water. The *aqueous infusion* or *decoction* of nux vomica is deeply reddened by nitric acid, and is freely precipitated by tincture of galls. Ferric sulphate gives with it an olive-green tint.

Strychnine.—This alkaloid may be readily obtained crystallized from an alcoholic solution. The crystalline form is subject to great variation, according to the strength of the solution, rapidity or slowness of evaporation, the presence of foreign matters, &c. It is commonly seen in octahedra, sometimes lengthened into prisms of a peculiar shape, bevelled at the ends, and crossing each other at angles of 60° (see Fig. 29). There are as many as six or eight varieties of crystals, so that too much importance must not be attached to this branch of the analysis. As strychnine is procured from the solutions of its salts by the addition of ammonia, it is usually deposited in long slender prisms (Fig. 30, p. 208).

Fig. 26.

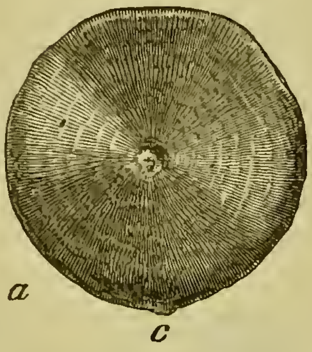
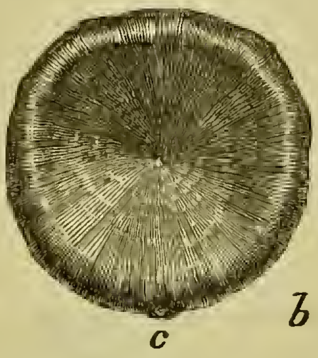
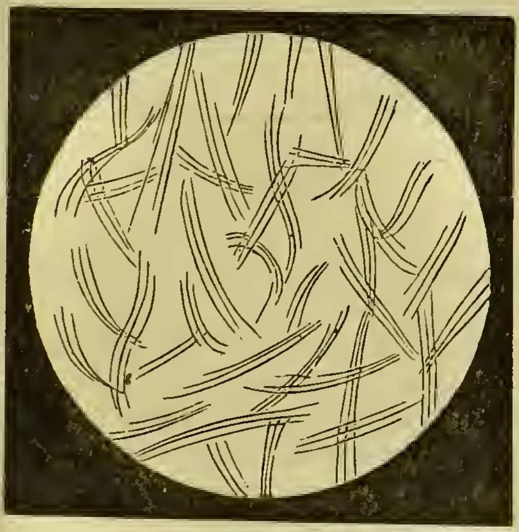


Fig. 27.



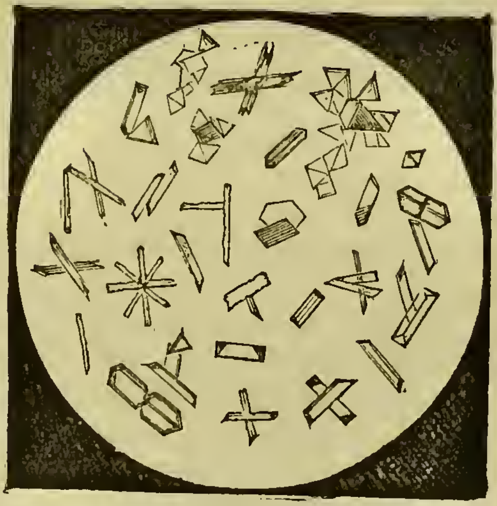
Seeds of Nux Vomica, natural size. *a*, Convex surface; *b*, concave surface; *c*, hilum or umbilicus.

Fig. 28.



Hairs of Nux Vomica, magnified 124 diameters.

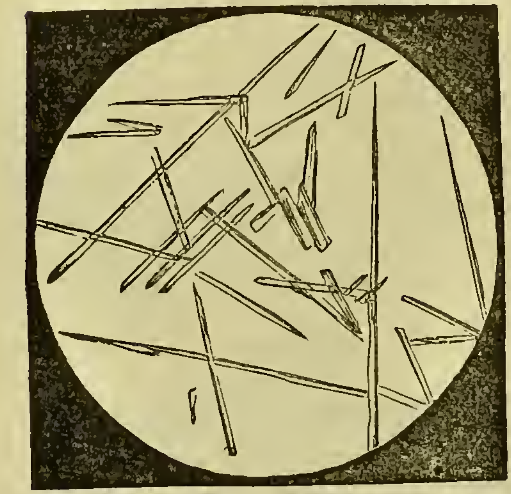
Fig. 29.



Various forms of Crystals of Strychnine, as they were obtained from an alcoholic solution, magnified 124 diameters.

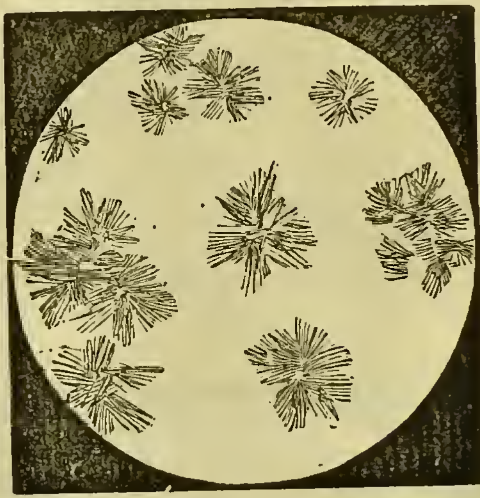
1. Strychnine is white, of an intensely bitter taste, even when it forms only the 1–30,000th part of a watery solution [or even much less. Ed.]. 2. When heated on platinum, it melts and burns like a resin, with a black smoky flame; in a close tube it yields ammonia. 3. It is not perceptibly dissolved by cold water, it requiring 7000 parts for its solution. 4. It is easily dissolved by acids, and it is precipitated from its concentrated solutions by potash or by ammonia, in which it is insoluble. 5. Strong nitric acid imparts to commercial strychnine a pale reddish colour, owing to the presence of brucine. 6. Sulphuric acid produces no apparent change in it; but when to this mixture a small crystal of bichromate of potassium, of ferricyanide of potassium, or a small quantity of black oxide of manganese or of peroxide of lead, is added, a series of beautiful colours (blue, purple, and violet) appear, passing rapidly to a light-red tint (green with bichromate). Among these substances black oxide of manganese will be found preferable for use.

Fig. 30.



Crystals of Strychnine obtained by adding ammonia to the sulphate, magnified 124 diameters.

Fig. 31.



Crystals of Chromate of Strychnine, magnified 124 diameters.

Horsley has suggested that a solution of strychnine should be sufficiently concentrated, and then precipitated by chromate of potassium: the crystals may be examined microscopically; they are gradually seen in tufts of radiated prisms of a yellow colour (Fig. 31). On being touched with strong sulphuric acid, the colour-reactions of strychnine are at once brought out. Chloride of gold is a delicate precipitant of strychnine. The precipitate, collected and dried, may be dissolved in concentrated sulphuric acid, and any of the colour-tests then applied to it. Iodic acid is not decomposed by strychnine or its salts, and sulphomolybdic acid gives to it slowly only a pale-blue colour. It is thus readily distinguished from morphine. In testing solutions of strychnine, the presence of alcohol should be avoided.

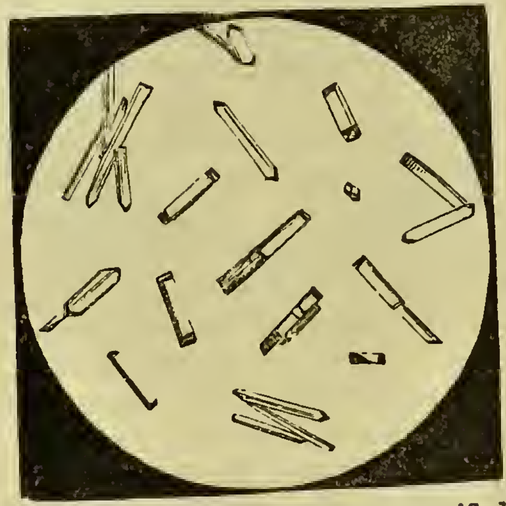
In *organic mixtures*, a modification of the process originally suggested by Stas may be employed for the separation of the alkaloid.

The principle of its operation consists in dissolving the strychnine with a gentle heat out of the tissue or organ, very finely cut up, by means of rectified spirit mixed with a small quantity of tartaric or acetic acid. The liquid is strained, and the residue well pressed and washed with alcohol; the acid solution of strychnine thus obtained is evaporated at a low temperature to dryness. The residue is exhausted with absolute alcohol, filtered, and the filtrate again evaporated to dryness at a low temperature. The residue is now taken up with water, filtered, and the liquid is neutralized by an alkali—potash or ammonia, the latter being in some respects preferable—and a slight excess of alkali is added. The alkaline liquid is then shaken, in a long stoppered tube, with twice its volume of ether or chloroform, or a mixture consisting of four parts of ether and one of chloroform. These liquids dissolve the strychnine set free by the alkali. The ethereal solution is separated from the watery liquid by a pipette or by a stoppered tube, and submitted to spontaneous evaporation, when, if strychnine be present, the alkaloid will be obtained, but generally associated with oily and other organic matters, which may interfere with the production of crystals. The impure residue left by the ether is heated in a water-bath, with a few drops of strong sulphuric acid: this destroys the organic matter. Water is added, and the acid liquid is filtered through paper, neutralized by potash, and again treated with ether, when strychnine will be obtained in small and slender prisms. The crystals, after an examination by the microscope (see Fig. 30, p. 208), are treated with sulphuric acid and peroxide of manganese, and the colour-reactions of strychnine, if the alkaloid is present, will appear. By this method strychnine has been detected in the liver of a person who died from this poison, although the organ was in a highly putrescent state. The process of dialysis (p. 74) will allow of the separation of strychnine, when combined with acids and in a state of solution, from blood, mucus, and other viscid organic matters found in the stomach. The liquid containing the salt of strychnine may be tested by evaporating a few drops and applying the colour-test. If thus found to be present, it may be neutralized by ammonia or potash, and shaken with ether or chloroform in order to obtain pure strychnine. In all cases the physiological test should be used to supplement the chemical tests for strychnine. A frog may be employed for this purpose. Whatever process may be adopted, the analyst should bear in mind that it is better to operate on a small quantity of strychnine in a pure state than on a large quantity in an impure state. Strychnine does not appear to undergo any change in the dead body from the process of putrefaction, but it may disappear from the stomach like opium or morphine, and owing to similar causes (see p. 168). In the case of *Reg.* v. *Pearson* (Durham Sum. Ass., July, 1875), where death was clearly traced to strychnine, only 1-16th part of a grain was found in the body by Scattergood. Had the man survived a few hours longer, probably none would have been found. Cameron found that in the case of a man who died from strychnine administered by his stepmother, not a trace of the poison could be detected through the entire viscera. This question is now in a great measure set at rest. A person may die from poison, although none may be detected in the body. Among recent cases that of *Chantrelle* may be quoted as an illustration (see p. 169). The editor of this work believes that much smaller quantities of strychnine may be detected when mixed with organic matters than the author (Dr. Taylor) admitted; and that, with improved methods of analysis, which cannot here be given in detail, strychnine can hardly fail to be detected in the body in any case of poisoning by this alkaloid proving fatal within a couple of hours. As a rule, it may be readily detected in the urine during the course of a case of strychnine-poisoning; and also when the alkaloid is only being given in ordinary medicinal doses. That strychnine is absorbed into the blood unchanged is incontestably proved by the experiments of Vulpian, who killed a dog by transfusing into its veins the blood of another strychnized animal.

BRUCINE.

Brucine, or *Brucia*, is an alkaloid associated with strychnine in the seeds of the nux vomica, but it is more abundantly contained in the bark of the tree. It is not so powerful a poison as strychnine, but the symptoms which it produces are similar. It is considered to have from one-twelfth to one-fortieth, or, according to others, one-sixth of the strength of strychnine. Brunton finds that brucine acts very like strychnine, producing death by convulsions when injected into the tissues or the blood. When taken into the stomach, it often does not produce convulsions, owing to its rapid elimination by the urine. ('Jour. of Chem. Soc.,' 1885, p. 143.) It is not affected by the colour-tests employed for the detection of strychnine, and it acquires an intensely red colour on the addition of nitric acid. The red colour turns to a beautiful violet on the careful addition of a solution of stannous chloride. It is much more soluble in water than strychnine, and has a similar bitter taste. Its aqueous solution is strongly alkaline, and, by spontaneous evaporation, it yields groups of slender prismatic crystals arranged in a fanlike shape. Unlike strychnine, it cannot be crystallized from a solution in benzene, and only imperfectly from a solution in alcohol. Hydrochloric and iodic acids produce in it no change, either in the cold or when heated. Sulphuric acid gives to it a pink-red colour without carbonizing it. The sulphate of brucine crystallizes in well-defined prisms truncated at the ends. They are larger and longer than the prisms of strychnine (see Fig. 32). From a case of poisoning with this alkaloid which occurred to Edwards, it is necessary to give a caution to medical men respecting the possible criminal use

Fig. 32.



Cystals of Sulphate of Brucine, magnified 24 diameters.

of brucine. The symptoms which it causes so closely resemble those of poisoning with strychnine, that, in the event of death, the latter poison only may be sought for and not found; the real poison, brucine, may be overlooked. The tetanic symptoms are more slowly produced by brucine, and the poison is not so rapidly fatal as strychnine; but these conditions may be altered by the larger quantity given.

When, in any suspected case, the colour-tests for strychnine fail to show the presence of this alkaloid, nitric acid should be added to the crystalline residue obtained (as in the process for strychnine) from ether or chloroform-ether. The intense reddening produced by this test, with the other characters above mentioned, will indicate the presence of brucine. Sulphomolybdic acid (p. 168) also yields a striking distinction between the two alkaloids. While it slowly gives a pale blue with strychnine, it rapidly gives a deep brick-red colour, passing to brown-red, with brucine or its salts.

CHAPTER 22.

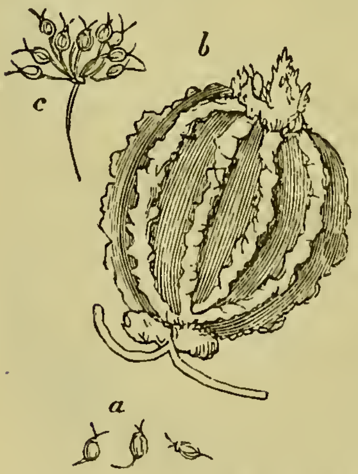
CONIUM MACULATUM.—HEMLOCK.—CONIA.—ŒNANTHE CROCATA.—ÆTHUSA CYNAPIUM. — WATER - PARSNIP. — LOBELIA. — FOXGLOVE. — DIGITALIN. — ACONITE.—ACONITINE.—LABURNUM.

COMMON OR SPOTTED HEMLOCK (CONIUM MACULATUM). CONIA.

Symptoms and Appearances.—The effects produced by hemlock have not been uniform: in some instances there have been stupor, coma, and slight convulsions; while in other cases the action of the poison has been chiefly manifested on the spinal marrow—*i.e.* it has produced paralysis of the muscular system. The poisonous effects usually appear early and advance somewhat rapidly. A peculiar muscular debility sets in; the lower limbs become weak, and eventually paralysed; the paralysis advances upwards, eventually reaching the respiratory muscles. There is difficulty of breathing, anxiety in the region of the heart, and, towards the close of life, convulsions, consciousness having been previously intact. The pupils are dilated, though not to the same extent as when atropine, or a solanaceous plant, has been taken. When the respiration becomes affected, there is marked blueness of the surface of the body. A man ate a large quantity of hemlock plant, by mistake for parsley. In from fifteen to twenty minutes there was loss of power in the lower extremities; but he apparently suffered no pain. In walking, he staggered as if he was drunk; at length his limbs refused to support him, and he fell. On being raised, his legs dragged after him, and, when his arms were lifted, they fell like inert masses, and remained immovable. There was perfect paralysis of the upper and lower extremities within two hours after he had taken the poison. There was loss of power of swallowing, and a partial paralysis of sensation, but no convulsions—only slight occasional motions of the left leg; the pupils were fixed. Three hours after eating the hemlock the respiratory movements had ceased. Death took place in three hours and a quarter; it was evidently caused by gradual asphyxia from paralysis of the muscles of respiration; but the intellect was perfectly clear until shortly before death. On *inspection*, there was slight serous effusion beneath the arachnoid membrane. The substance of the brain was soft; on section there were numerous bloody points, but the organ was otherwise healthy. The lungs were gorged with dark fluid blood; the heart was soft and flabby. The stomach contained a green-coloured pulpy mass resembling parsley. The mucous coat was much congested, especially at its greater end. Here there were numerous extravasations of dark blood below the membrane, over a space of about the size of the hand. The intestines were healthy, except that they here and there presented patches of congestion in the mucous coat. The blood throughout the body was fluid and of a dark colour.

In a case which was the subject of a trial for murder (*Reg.* v. *Bowyer*, Ipswich Sum. Ass., 1848), a child died in one hour after swallowing part of a teacupful of a decoction of hemlock, alleged to have been administered by the mother. The child sipped the decoction until it lost the power of holding the cup; it became insensible and paralysed, and died in the chair in a sitting posture. There were no morbid appearances, and no hemlock leaves were found in the body, these having subsided in the cup and been left in the dregs. The child had been poisoned by the upper stratum of clear liquid. The mother was acquitted for want of proof, the death of the child having taken place in secrecy.

Fig. 33.



a, Seed of Hemlock, natural size.
b, The same, magnified 30 diameters.
c, Group of Seeds.

Analysis.—Hemlock is known from most other plants which resemble it by its large round smooth stem, with dark purple spots. The leaves are of a dark-green colour, smooth and shining. Every portion of the plant has a peculiar and disagreeable smell when bruised, resembling cat's urine, or, according to some, the odour of mice. It is strongly brought out when the stem, leaves, or seeds are rubbed with a solution of caustic potash. An illustration of the *seeds* of hemlock is annexed (Fig. 33). They are peculiar in their form, and are easily distinguished from the seeds of other umbelliferous plants. A person may be poisoned by a decoction of *leaves* of hemlock, and no leaves be found in the stomach or bowels (case of *Bowyer, supra*). In this case the stomach had been emptied, and the contents lost, before it was sent for analysis. No trace of conia was found.

Conia.—The poisonous alkaloid of hemlock is known under the names of *Conia*, conine, coniine, conicine, and conicina. It resembles nicotine and ammonia in its liquidity, volatility, alkaline reaction, and in some of its chemical properties. It is a liquid of oily consistency, of a pale-yellow colour, powerfully alkaline, and has, when its vapour is diluted, a smell resembling that of mice, and an acrid bitter taste. It gives a volatile greasy stain to paper, and burns with a yellow flame and thick smoke. In reference to its presence in *organic mixtures*, it may be detected by its peculiar odour, or by distilling the liquid with a solution of potash and examining the distillate. It may also be separated by the process of Stas.

The reactions produced by tests on small quantities should be distrusted, unless there is strong evidence of the action of the poison on the body from the symptoms.

WATER-HEMLOCK, OR COWBANE (CICUTA VIROSA).

Symptoms and Appearances.—The symptoms produced by the roots of this plant are giddiness, dimness of sight, headache, and difficulty of breathing. There is burning pain in the stomach, with vomiting, and these symptoms are accompanied by heat and dryness of the throat. Convulsions have been observed to precede death. In the cases of three children who died in convulsions from this poison, Mertzdorff found an injected state of the mucous membrane of the stomach, with redness of the air-passages, as well as of the cardia and pylorus; the vessels of the brain and the sinuses were filled with dark liquid blood. (Wibmer, 'Cicuta,' 119.)

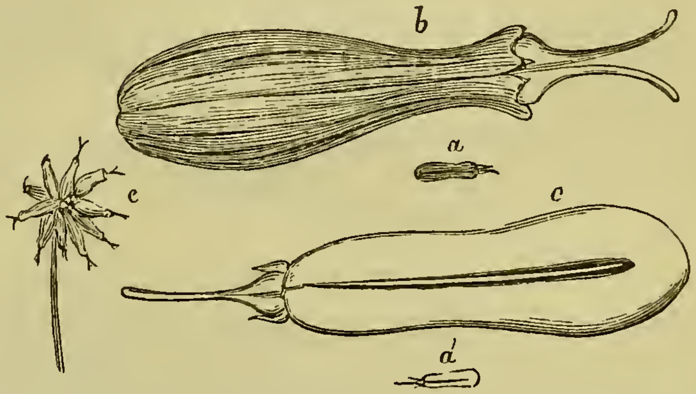
The roots of the five-leaved water-hemlock, *Œnanthe phellandrium* (*Phellandrium aquaticum*), have been eaten in mistake for parsnips, and produced symptoms of poisoning.

HEMLOCK WATER-DROPWORT (ŒNANTHE CROCATA).

This umbelliferous plant, known also as five-finger root, or dead-tongue, grows on the banks of rivers, streams, and ditches. It is one of the most poisonous of the order, and is considered to be one of the most virulent of English vegetable poisons. It has often been mistaken for celery.

Symptoms and Appearances.—In 1857, two cases of poisoning with this plant occurred at West Bolden, in Durham. Two labourers ate some of the roots of the œnanthe. They were found soon afterwards lying insensible and speechless, with livid faces, swollen and protruded tongues, and there were convulsive movements of the jaws, with frothy mucus and blood about their mouths; the eyes full and projecting, the pupils dilated, the breathing stertorous and laboured, with occasional general convulsions. The men both died in an hour and a half from the time at which they were first discovered. On *inspection*, it was found that there had been bleeding from the ears; the abdomen was livid and swollen. The stomach contained a gruelly liquid with some of the partly digested roots; on removing this liquid, the lining membrane was found congested and softened. The lungs were engorged with dark liquid blood, and the blood contained in the heart was in a similar state. Boyle, to whom these cases occurred, forwarded to the author a portion of the roots, and there was no doubt that they were the roots of the œnanthe crocata. Drinkwater gives an account of three cases of poisoning by this plant, in 1875, two of which proved fatal. It seems that three boys ate the roots and stems of the plant, which they supposed to be wild carrots. They had a sweet, nutty taste. One boy complained of feeling cold, and was attacked with severe vomiting and purging. After this he recovered, and was able to give evidence at the inquest on his two companions. A second boy was found dead in the road about fifty yards from the brook where the œnanthe grew. He had vomited, struggled, and been violently convulsed. His face was black, and froth had escaped from his mouth. The third boy was found in a similar condition—dead, with froth about his mouth. The post-mortem examination revealed congestion of the brain with black fluid blood, engorgement of the lungs and heart with the same, congestion of the mucous membrane of the stomach. This organ contained the masticated root of the œnanthe, with some of the green leaves. (For other cases, see 'Med. Gaz.,' vol. 34, p. 288.) This plant is equally fatal to animals. Cameron states that forty-three oxen, turned into a pasture in which the œnanthe grew, were killed by eating the plant. Foaming at the mouth, shivering, difficult breathing, tetanic spasms, with pleuro-thotonos, or spasmodic bending of the body to one side, were among the symptoms. ('Lancet,' 1873, i. p. 918.)

Fig. 34.



Seeds of Œnanthe Crocata. *a*, Natural size; *b*, magnified 30 diameters. *c*, One-half of a Seed magnified. *d*, One-half natural size. *e*, Group of Seeds.

It is not often that attempts are made to destroy persons by the administration of these vegetable poisons; but a case occurred in France in which a woman attempted to poison her husband by mixing slices of the root of this plant with his soup. His suspicions were excited by the acrid taste of the soup. The woman was tried for the crime, and Toulmouche deposed at the trial that the plant from which the root had been taken was the œnanthe crocata—that it was a powerful poison, and might cause death in two or three hours. The prisoner was convicted. ('Gaz. Med.,' Jan. 3, 1846, 18; also 'Jour. de Chim. Méd.,' 1854, 533.)

Analysis.—The œnanthe crocata can be identified only by its botanical characters. The leaves are of a dark-green colour, with a reddish-coloured border. They have no unpleasant odour when rubbed.

The seeds, of which an illustration is annexed (Fig. 34, p. 214), are peculiar. The plant bears a greater resemblance to celery than most of the other umbelliferæ. Its stem is channelled, round, smooth, and branched, of a yellowish-red colour, and growing to the height of two or three feet. The root, consisting of a series of oblong tubercles, with long slender fibres, is of a yellowish-white colour, and not unpleasant to the taste. It is the most active part of the plant. The leaves yield much tannic acid to water, but the decoction appears to contain no alkaloidal base, since the chloriodide of potassium and mercury produces no precipitate in it. The roots and stems of this plant are more frequently eaten than the leaves or seeds.

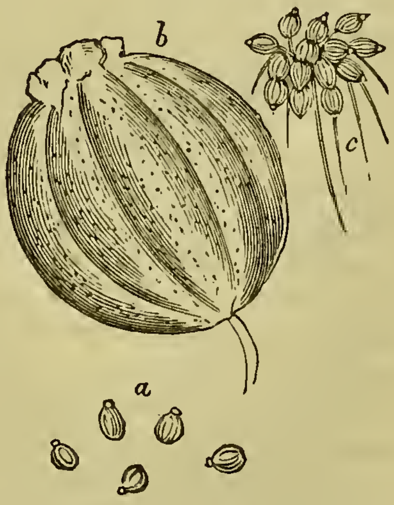
FOOL'S PARSLEY (ÆTHUSA CYNAPIUM).

FOOL'S PARSLEY, or LESSER HEMLOCK, is very common in gardens and hedgerows. The leaves so closely resemble those of parsley that they have often been gathered by mistake.

Symptoms and Appearances.—In May, 1845, a girl, æt. five years, in good health, ate the bulbs of the æthusa by mistake for young turnips. She was suddenly seized with pain in the abdomen, followed by a feeling of sickness; but she did not vomit. She complained of feeling very ill. On trying to eat, she could not swallow. She was incapable of answering questions, and her countenance bore a wild expression. The lower jaw became fixed, so as to prevent anything being introduced into the mouth. She then became insensible, and died in *an hour* from the commencement of the symptoms: so far as could be ascertained, there were no convulsions. A second child, æt. three years, shortly after eating the same substance, was attacked with pain in the stomach, sickness, vomiting, and profuse perspiration. She soon recovered, with the exception of suffering severe griping pains without purging; but these disappeared on the following day. A third child, of the same age, suffered from similar symptoms. Recovery in the two last cases was probably due to the plant having been eaten on a full stomach, and to the effect of early and copious vomiting. ('Med. Times,' Aug. 23, 1845, 408.)

This plant is known from garden parsley by the smell of its leaves when rubbed, which is peculiar, disagreeable, and very different from that possessed by the leaves of parsley. The leaves of fool's parsley are finer, more acute, and of a darker green colour. The seeds are also peculiar. They are represented in the annexed illustration (Fig. 35). Its flower-stem, which is striated or slightly grooved, is easily known from all other umbelliferous plants by the beard, or three long pendulous leaves of the involucrum under the flower. The flowers

Fig. 35.



Seeds of Fool's Parsley.
a, Natural size.
b, Magnified 30 diameters.
c, Group of Seeds.

are white, whilst those of the garden parsley are of a pale-yellow colour. Jno. Harley denies the existence of poisonous properties in this plant. (See 'On Poisons,' 3rd edit. p. 745.)

Water-Parsnip.

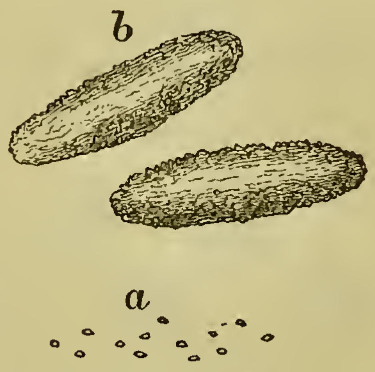
This plant (*Sium latifolium* and *S. angustifolium* or *S. nodiflora*) is not unlike the watercress, for which it has been mistaken. Two girls, aged five and three years respectively, died in 1882 from eating the leaves. After these were eaten, the younger child became suddenly ill and died; while the other succumbed two days later. ('Brit. Med. Jour.,' 1882, ii. p. 26.)

Indian Tobacco (Lobelia inflata).

The powdered leaves of Indian tobacco contain an active principle, *lobeline*, capable of producing poisonous effects on the brain and spinal marrow, attended with irritation of the stomach and bowels. When administered in doses of from ten to twenty grains, lobelia operates as an emetic; but in larger quantity it may act deleteriously. In one case a man lost his life by swallowing *one drachm* of the powdered *leaves*, prescribed by a quack. This person was seen by a medical practitioner soon after he had taken the poison: he was evidently suffering great pain, but he was quite unconscious—the pulse was small, and the pupils were strongly contracted and insensible to light. He had vomited the greater part of the poison. He suffered from spasmodic twitchings of the face, sank into a state of complete insensibility, and died in about thirty-six hours. On inspection, some fluid was found in the stomach, but none of the powder. The gastric mucous membrane was intensely inflamed, and the vessels of the brain were greatly congested. ('Pharm. Times,' 1847, p. 182.) The *seeds* of lobelia are equally poisonous. In the 'Med. Times and Gaz.,' 1853, ii. p. 568, two cases are reported in which the seeds proved fatal. In one, the mucous membrane of the stomach was highly inflamed. Another case is referred to in the same journal (1853, i. p. 270). There have been many inquests and trials for manslaughter in this country as the result of the improper administration of the leaves of the *Lobelia inflata* by ignorant quacks ('Coffinites'), calling themselves medical botanists, and dealers in vegetable medicines. The medical evidence given on these trials has proved that in large doses lobelia is a most noxious drug. (See 'Med. Gaz.,' vol. 44, pp. 383 and 433; vol. 46, p. 384; 'Lancet,' 1853, i. p. 237; 'Pharm. Jour.,' Aug. 1851, p. 87; and for some remarks on the action of the poison, see a paper by Curtis and Pearson, 'Med. Gaz.,' 1850, vol. 46, p. 285.) Those who profit by the sale of this drug among the ignorant poor maintain the doctrine that it cannot kill, and never has been known to destroy life. In 1856, one of these quacks was convicted on a charge of manslaughter for killing a woman with overdoses of lobelia. Severe pain, followed by loss of consciousness and congestion of the brain, were the chief symptoms preceding death. The admission that in proper doses it was a useful remedy in spasmodic asthma was of no avail on this occasion. The man was sentenced to three months' imprisonment. (*Reg.* v. *Boyden*, or *Jackson*, Lincoln Sum. Ass., 1856.) A man named *Riley Drake* was convicted in the United States of having caused the death of a woman by administering lobelia in improper doses. (Wharton and Stillé's 'Med. Jur.,' p. 522.) In 1882, a man suffering from heart-disease, and who was an enormous eater, took as an emetic a medicine containing lobelia prepared from Coffin's prescriptions. At the post-mortem examination, made twelve hours after death, an aperture about the size of a goose-quill was found in the lesser curvature of the stomach, and about two pints of liquid having a milky appearance in the peritoneal cavity. The stomach itself contained lobelia seeds and cayenne pepper. The dictum of the so-called Coffinites is that 'heat is life; and the want of heat, disease and death.' In accordance with their principles, their drugs are lobelia and cayenne. ('Brit. Med. Jour.,' 1882, 2, p. 24.) In 1884 (*Reg.* v. *Wallis*, C. C. C., Jan. 1884), an herbalist was acquitted when tried for the manslaughter of an invalid woman named Sainsbury. The deceased, who was suffering from chronic lung-disease, took some of the prisoner's medicine, the essential ingredient of which was lobelia. She died in a few minutes. At this trial many herbalists, and two medical men, swore that lobelia was not a poison. The editor believes that, when full doses are given, the safety of the patient is usually ensured by the copious vomiting that ensues. When vomiting does not supervene, death may ensue. The woman Sainsbury died quickly without having vomited.

Lobelia is seen in the form of a greenish-coloured powder (fragments of leaves). This powder acquires a reddish-brown colour with strong nitric acid, and is blackened by concentrated sulphuric acid. Iodine water has no effect upon the infusion. Ferrous sulphate, and ferric chloride, produce with it a dark-green-colour—the ferric chloride very rapidly. The leaves and seeds contain an acrid substance called *Lobelacrin.* It acts as a powerful emetic in doses of from one-half to one grain. The leaves of lobelia are generally seen in fragments which do not readily admit of identification by the microscope. The *seeds* are very small, of a lengthened oval shape (Fig. 36), reticulated on the surface with projecting hairs or fibres, and of a light-brown colour. The discovery of them among the fragments of leaves would furnish a sufficient proof of the presence of lobelia. In one case (*Reg.* v. *Wallis, supra*), the editor succeeded, by a modification of Stas's process (see Strychnine, p. 208, *ante*), in extracting a quantity of the volatile alkaloid, *lobeline*, from the stomach of the deceased woman. Lobeline is similar to nicotine in its properties.

Fig. 36.



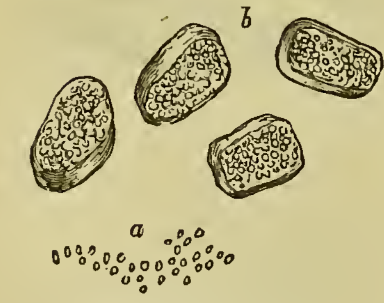
Seeds of Lobelia.
a, Natural size.
b, Magnified 70 diameters.

FOXGLOVE (DIGITALIS PURPUREA). DIGITALIN.

Purple foxglove is a well-known hedge-plant growing abundantly in England. All parts of the plant—the seeds, leaves, and root—are poisonous, owing to the presence of the poisonous principle, *digitalin.* The leaves, whether in the form of powder, infusion, extract, or tincture, exert an action on the brain and spinal marrow, as well as on the stomach and bowels. They retain their noxious properties when dried.

Symptoms and Effects.—Cases of poisoning with foxglove are not very common. A boy who took, by the advice of a quack, six ounces of a strong decoction of the *leaves*, suffered from vomiting, purging, and severe pain in the abdomen. After some time, he became lethargic, and slept for several hours; in the night he was seized with convulsions. The pupils were dilated and insensible to light; the pulse was slow, small, and irregular; coma followed, and the boy died twenty-two hours after taking the poison. On *inspection*, the membranes of the brain were found much injected, and the mucous membrane of the stomach was partially inflamed. The prisoner was acquitted of the charge, because he had only given his fatal advice on the application of the friends of the deceased. ('Ed. Med. and Surg. Jour.,' 27, p. 223.) A young man swallowed a strong *decoction* of foxglove by mistake for purgative medicine. He was soon seized with vomiting, pain in the abdomen, and purging. In the afternoon he fell asleep. At midnight he awoke, was attacked with violent sickness, colic, and convulsions; the pupils were dilated and insensible to light, the pulse slow and irregular. He died twenty-two hours after taking the poison. (Wibmer.) A few grains of the powdered leaves have been known to produce giddiness, langour, dimness of sight, and other nervous symptoms. A drachm has, however, been taken without causing death; but in this instance it produced violent vomiting. A common effect of this poison is to produce great depression of the heart's action. 'Blue-vision' is said to be a not uncommon occurrence in poisoning by digitalis; *i.e.* the patient sees all objects as it were of a blue colour. Tardieu has also described a blue condition of the sclerotic coat of the eye as characteristic of poisoning by digitalis and *digitalin.*

Fig. 37.



Seeds of Foxglove.
a, Natural size.
b, Magnified 30 diameters.

When foxglove has been taken in substance, *i.e.* in the form of seeds or leaves, or any portion of these has been swallowed in a decoction or infusion, fragments may be found in the stomach and bowels. In reference to the infusion, decoction, tincture, or extract, except there be sufficient to allow of the separation of digitalin, there is no chemical process known by which the poison may be recognized. If any fragments of leaves or seeds are found in the contents of the stomach or in food, they may be identified by the aid of the microscope. The illustration (Fig. 37, p. 218) represents the *seeds* of foxglove; they are of a reddish-brown colour, remarkably small, oblong, and somewhat angular in shape. They have peculiar markings. By the aid of the microscope, they may be easily distinguished from the seeds of hyoscyamus, datura, belladonna, and most other poisonous plants.

Digitalin is an active substance obtained from digitalis. The French and German articles are not identical; and both are amorphous mixtures of several chemical substances. German digitalin is chiefly used in this country. The physiological actions of digitalin (so called) have been investigated by Homolle ('Jour. de Pharm.,' Jan. 1845), by Bouchardat ('Ann. de Thérap.,' 1864, p. 155), by Fagge and Stevenson ('Guy's Hosp. Rep.,' 1866, p. 37), and others. Commercial digitalin operates as a poison on man and animals in very small doses. One sixteenth of a grain, which is considered to be equal to eight grains of the well-prepared powder of the dried leaves, is sufficient to cause symptoms of poisoning. Doses of from 1-11th to 1-32nd part of a grain have lowered the pulse and caused nausea, vomiting, griping, purging, and an increased secretion of urine. (Pereira, 'Mat. Med.,' vol. 2, p. 528.) Doses of from one quarter to one-half of a grain would probably prove fatal to life. Digitalin has acquired some notoriety by reason of the trial of *Dr. De la Pommerais*, at Paris, in May, 1864, for the murder of a woman named *Pauw*. (See 'ON POISONS,' 3rd edit., p. 801; 'Ann. d'Hyg.,' 1864, t. 2, p. 105.) Nativelle has obtained a *crystallized digitalin* from the foxglove. This was found by Goerz to be physiologically inactive. It is associated in commercial digitalin with *digitaleïn*, which possesses all the physiological activity of digitalis.

The bark, seeds, berries, and leaves of the *Mezereon, Privet, Holly*, and *Guelder rose* have in a few cases given rise to symptoms of poisoning. These poisons affect the brain and the alimentary canal, producing vomiting and purging, followed by insensibility and convulsions. Accidents from these plants are not frequent, and when they occur there is usually sufficient botanical evidence of the nature of the poison taken.

MONK'S-HOOD (ACONITUM NAPELLUS). ACONITINE.

This well-known garden plant is in some parts of the country called *Wolf's-bane*, and in Ireland *Blue-rocket*. The roots, seeds, and leaves are highly poisonous, owing to the presence of the alkaloid *aconitine;* the root is especially noxious, and, when the leaves have fallen off, it appears to possess its greatest virulence. These parts of the plant, when masticated, produce a peculiarly cool, numbing sensation, affecting the lips, tongue, and interior of the mouth generally. At first the root appears to be tasteless, as the effects are only strongly manifested after a few minutes. After tasting only a small portion of the dried root, this disagreeable sensation remains on the tongue and lips for several hours. In larger quantity the taste has been described as burning, and it is followed by a hot acrid sensation in the throat, and salivation.

The roots of *Aconitum ferox*, the Indian bikh or bisch, and those of Japanese aconite from *A. Fischeri*, are also articles of commerce, and are as poisonous as the ordinary *A. napellus*. The official tincture, *Fleming's tincture*, the extract, the alcoholic extract (not official), and the liniment, may all be productive of fatal results.

Symptoms and Appearances.—In from three to five minutes after chewing the root of aconite, or after contact of any of its preparations with the tongue, a hot burning astringent sensation is experienced on the tongue, extending to the fauces and to the lips, especially the lower. The sensation soon becomes very severe, and is accompanied by a certain amount of salivation and a sensation of swelling in the fauces, and there may be difficulty in the swallowing. The sensation is described by some as one of numbness, and there is a decided loss of sensation locally. Later the feeling is one as if the tongue had been seared with a hot iron. Vomiting usually sets in in an hour or two at the latest; and is usually severe and spasmodic. The patient feels cold, especially in the extremities, and the skin is cold, clammy, and perspiring. There may be a feeling of numbness extending over the whole body, or a sensation of impending paralysis. Poisoning by the *root* of aconite is by no means unfrequent. In the spring or autumn, the root is liable to be mistaken for that of horse-radish. It has been thus accidentally eaten on several occasions, and has caused death. A mistake of this kind led to fatal results in three hours in a case which occurred at Lambeth; and another set of cases occurred at Dingwall, in 1856. Here three persons were poisoned by reason of their having had sauce made with the root of aconite, served at dinner with roast beef in place of horse-radish sauce. They were healthy adults; they all died within three hours and a half. These mistakes show deplorable ignorance, but there is always the risk of their occurrence when horse-radish and aconite are grown near to each other in a garden, at that season of the year when the leaves have fallen.

A trial for murder by poisoning with the root of this plant took place at the Monaghan Lent Assizes in 1841 (*Reg.* v. *McKonkey*), in which Geoghegan conducted the medico-legal investigation. The medical evidence was beset with difficulties, for no trace of the poison could be discovered in the body; and it was only by a close analysis of symptoms and appearances that the charge was brought home to the prisoner. The deceased had eaten for his dinner some greens dressed for him by the prisoner, and complained of their having a sharp taste; and this was perceived also by another person present who tasted them. It was ascertained that soon after the meal the deceased had vomited a greenish matter, and suffered from purging, restlessness, incoherence, lock-jaw, and clenching of the hands. He died in about three hours after having eaten the greens, but was not seen by a medical man while living. The chief appearance met with was in the stomach, where the mucous membrane was of a light, reddish-brown colour. Traces of vegetable matter were found in the intestines; but no poison could be detected, either botanically or chemically. The symptoms suffered by a friend of the deceased, who had accidentally tasted the greens, were very characteristic of poisoning by aconite. In *two* minutes he felt a burning heat in the mouth, throat, gullet, and stomach; then a sensation of swelling in the face, with a general sensation of numbness and creeping of the skin. Restlessness, dimness of sight, and stupor, almost amounting to insensibility, followed; and in about an hour after the meal he was found speechless, frothing at the nose and mouth, the hands and jaws clenched, appearing occasionally as if dead, and then again reviving. There was vomiting, purging, tenderness at the pit of the stomach, cramps, tingling of the flesh, and a burning taste in the mouth followed. This man did not entirely recover until after the lapse of five weeks. The prisoner was convicted of murder, and confessed before her execution that the powdered *root* of aconite had been mixed with pepper, and sprinkled over the greens. ('Dub. Med. Jour.,' vol. 19, p. 403.)

The tincture of the *root* is a powerful poison. In 1853, a woman took by mistake *seventy minims of Fleming's tincture* of the root mixed with one grain of acetate of morphine. In a few minutes she became very thirsty, complained of a burning sensation and pain in her stomach, to relieve which she swallowed a quantity of cold water. In fifteen minutes there was violent vomiting, which continued for two hours. She lost the power of standing, and was very restless. The pain in the stomach increased, and there were convulsive movements of the muscles. She was conscious until shortly before her death, which took place in about four hours after she had taken the poison. There were no general convulsions: the pain in the stomach was well marked throughout. On *inspection*, the membranes of the brain were congested, but the brain itself was firm and healthy. The lungs were healthy, the heart flaccid, the womb congested. The stomach contained some mucus, and the lining membrane at the larger curvature was injected (reddened) in patches, but otherwise natural. The mucous membrane of the duodenum was in a high state of inflammation, partially abraded, softened, and broken down. Some spots were of a very dark colour, passing into gangrene. In 1852, an Excise officer lost his life by merely tasting Fleming's tincture of aconite, under the supposition that it was flavoured spirit. He was able to walk from the Custom-House over London Bridge; but he died in about four hours after tasting the poison.

The case of the man *Hunt*, who, in Nov. 1863, destroyed his wife and children by prussic acid, and himself by aconite, presents some features of interest in reference to the symptoms and appearances produced by the *tincture*. The quantity taken by him was not determined; but the man was soon afterwards seized with violent spasmodic retching; the face was pale, the skin cold and clammy, the pulse small and hardly perceptible, and the action of the heart feeble. The pupils were much dilated, and the eyes brilliant and sparkling; the breathing was quiet and regular, except during the fits. He complained of pain in his heart. In attempting to walk, he staggered, and had no power to raise his arms. He was perfectly conscious, called for writing materials, and wrote a few lines. He then became suddenly worse, and a quarter of an hour before his death he lost all power and sensation in his limbs, the sharpest pinches producing no impression. The pulse was imperceptible. There were no convulsions, but complete relaxation of the limbs at death, which appeared to arise from syncope three quarters of an hour after he had taken the poison. On *inspection*, forty-two hours after death, there was great rigidity of the muscles. The substance of the brain was firm and healthy; the vessels on the surface were filled with blood. The heart was healthy; the right side was greatly distended with dark fluid blood; the left side contracted and quite empty. The lungs were healthy. In the abdomen, the viscera were healthy, with the exception of the stomach and duodenum. There was great capillary congestion at the larger end of the stomach, the mucous membrane having a bright-red colour. There were marks of irritation, with softening and separation of the mucous lining, the whole of the membrane being in a highly corrugated condition. Traces of an alkaloid were found in the contents of the stomach. The deceased had provided himself with an ounce of the tincture of aconite, and had swallowed the greater part of this mixed with water.

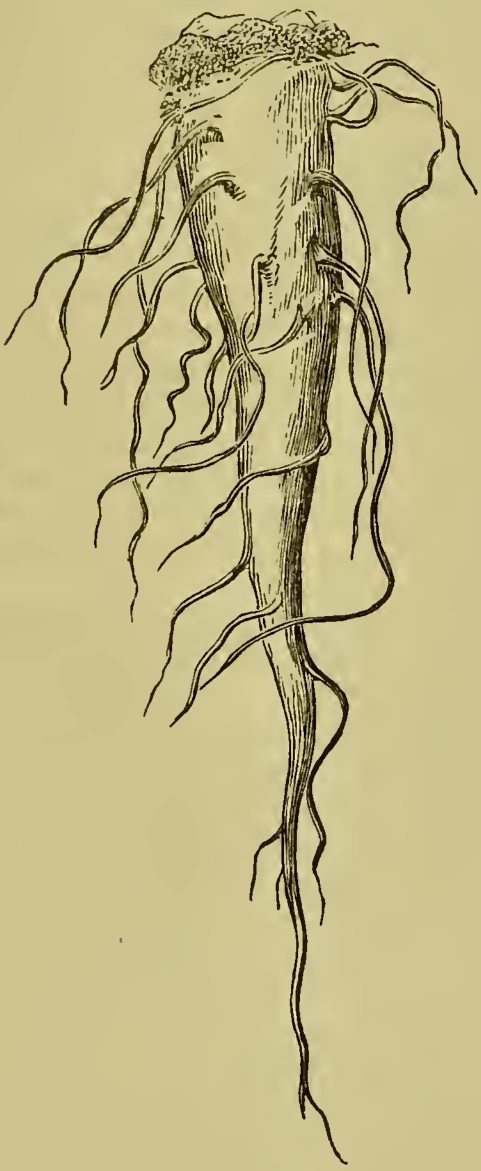
In 1884, the editor met with two fatal cases of poisoning by mixtures of aconite and belladonna liniments. The symptoms differed in no way from those of aconite-poisoning, except that the pupils were markedly dilated. In one of these cases he obtained aconitine and atropine from the stomach of the deceased woman, as was proved, not only by the chemical, but also by the physiological, properties, of the alkaloids. A similar case has been recently reported. (' Brit. Med. Jour.,' 1885, i. p. 327.)

Fatal Dose.—Of the *root* 60 grains have proved fatal, but it is probable that this is much in excess of the minimum fatal dose. Of the pharmacopœial tincture two or three drachms might probably be fatal. *Fleming's tincture* is six times as strong, and twenty-five minims have killed an adult. Four grains of *alcoholic extract* have proved fatal. Of the *official* (non-alcoholic) *extract* two grains have proved fatal (see above). It is very uncertain in its action; but is much less active than the alcoholic extract. The *liniment* is stronger than even Fleming's tincture, and eight times the strength of the pharmacopœial tincture; twenty minims would probably form a fatal dose.

Analysis.—The botanical characters of the leaves and root, when any portions can be obtained, will enable a medical witness to identify this vegetable poison. The root has been frequently and fatally mistaken for horse-radish, but there are these striking differences:—1. Aconite root is very short, conical, and tapers rapidly to a point (Fig. 38, p. 223). 2. It is externally of an earthy-brown colour, internally white, and of an earthy smell; the cut surface is rapidly reddened by exposure to air. It has numerous long thin fibres proceeding from it. 3. It has at first a bitter taste, but after a quarter of an hour or twenty minutes it produces a disagreeable sense of tingling and numbness on the lips and tongue. 4. Horse-radish root is long, cylindrical, or nearly so, and of the same thickness for many inches (Fig. 39, p. 223). It is externally whitish-yellow, and has a pungent odour when scraped. 5. Its taste is sometimes bitter, but it produces an immediate hot or pungent sensation.

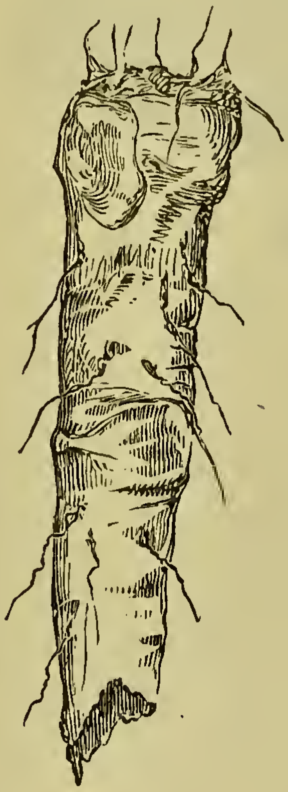
The leaves of monk's-hood are of a dark-green colour and of a peculiar shape. When masticated they slowly produce on the lips and tongue the persistent sense of tingling and numbness, with the sense of coolness observed in the root. They are less powerful than the root and seeds. The seeds are dark-coloured and differ in appearance from those of other poisonous plants (Fig. 40, p. 224).

Fig. 38.



Root of Aconite.

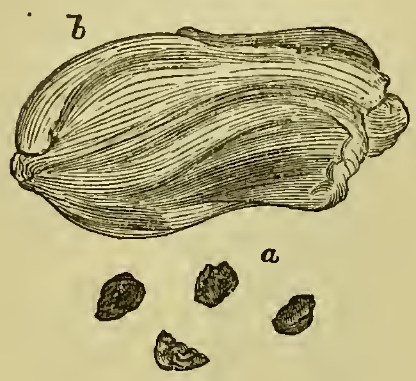
Fig. 39.



Root of Horse-radish.

Aconitine.—The chief alkaloid of *A. napellus* is *aconitine*, *aconitia*, or *aconitina*; and is, perhaps, the most formidable known poison, the fatal dose being probably one-twentieth of a grain. *A. ferox* contains a closely allied alkaloid known as *pseudaconitine*; and Japanese aconite roots yield a third alkaloid, *japaconitine.* The editor has found that all these alkaloids are toxic, producing similar effects when administered to animals, and that they are of almost equal physiological activities. Commercial samples of aconitine are of varying degrees of activity and purity; most of the German or 'exotic' varieties being comparatively inert. Pseudaconitine and japaconitine are not articles of commerce. The statement of some authors that the special preparation known as Morson's is pseudaconitine, prepared from the roots of the Indian plant, is incorrect. The inertness of the exotic preparations is due to admixture with other and inert alkaloids, partly existent in the plant, and partly the products of decomposition during the manufacture. Indeed, the active alkaloids aconitine, pseudaconitine, and japaconitine are somewhat of the nature of glucosides, readily undergoing a kind of saponification and splitting up into an acid and a comparatively inert basic body. Thus aconitine in ammoniacal mixture speedily splits up into another base, aconine, and benzoic acid. Duquesnel first, and subsequently Wright ('Year-Book of Pharmacy,' 1880, p. 455), have pointed out the conditions essential for success in the manufacture.

Fig. 40.



a, Seed of Aconite, natural size.
b, The same magnified 30 diameters.

In 1880, three cases of poisoning with crystallized nitrate of aconitine occurred in Holland ('Schmidt's Jahresb.,' 189, p. 122; 'Berl. Klin. Wochenschr.,' 1880, p. 337); and one of them proved fatal. The first was the case of a weakly man, sixty-one years of age, suffering from chronic bronchitis and a febrile attack. For this there was prescribed a solution of nitrate of aconitine. The patient took five drops, containing 0·006 of a grain of the nitrate, at 7 p.m. This produced an astringent and burning taste in the mouth extending to the stomach. At 9 p.m. the dose was increased to twenty drops (= 0·025 of a grain); and this dose was repeated at 8 a.m., 11 a.m., 4 p.m., 9 p.m.; next day, at 10 p.m., a final dose of ten drops (= 0·012 grain) was taken. In all one-seventh of a grain of the nitrate was taken in seven doses. After every dose the patient was seriously indisposed, so that eventually his life was in jeopardy. The symptoms were a feeling of coldness, cold clammy perspiration, severe vomiting, difficult respiration, great lassitude, and the patient felt as if he were about to become paralysed. There were intermittent deafness and blindness, and spasmodic twitchings of the whole body, but more especially of the muscles of the face. At one time he felt that he was dying, and stated that he had been poisoned. The respiration became stertorous and quickened; then slow and gasping. There was no loss of consciousness. It is not stated that there was any loss of sensation or any actual paralysis.

In the second case, a man, æt. 62, took an undetermined dose of the same medicine. When seen he had cold clammy perspiration, a weak, irregular, dicrotic pulse, and was conscious. The respirations were short, laboured, irregular, and superficial. The pupils were contracted, and responded feebly to light. There was no difficulty in swallowing. There was great precordial anxiety, and *facies hippocratica*. Suddenly, the pulse entirely ceased, though the cardiac beats could still be feebly heard; and a deathly pallor supervened. The patient rolled from side to side of the bed. The pupils were now dilated. Tonic convulsions of the facial muscles set in, with trismus; then, three hours after the dose, clonic convulsions, and the patient lost consciousness. In five or six minutes muscular relaxation ensued, but the convulsions returned in a quarter of an hour. An hour later death appeared imminent. Vomiting now set in, the pulse improved, and in twenty-one hours the man was convalescent.

The third case terminated fatally. Dr. Mayer, who had prescribed for the above patients, himself took from fifty to sixty drops of the solution of nitrate of aconitine prescribed for the first patient. This corresponds to 1-13th to 1-21st of a grain of the nitrate. It may be assumed that the dose was probably 1-16th of a grain. The symptoms commenced in an hour and a half; but they were not accurately noted till 8 p.m., four hours after the alkaloid had been taken. He was then found with a small, weak, irregular, but not slowed pulse, cold skin, and contracted pupils. He had an astringent and burning pain in the mouth, extending to the stomach, and difficulty in swallowing. The tongue was swollen. There was great precordial anxiety. He complained of burning pain, weakness, and heaviness of the limbs—especially the lower, which felt cold. Suddenly vision was lost, and the pupils became dilated. Soon, however, they again contracted, and vision was restored. Vomiting was procured by tickling the fauces. At 4.40 p.m. severe convulsions first set in, with stertorous respiration, singing in each ear alternately, and deafness. Ether was employed hypodermically, and its use was followed by renewed vomiting and convulsions. The pulse nevertheless improved, and ether was again injected. In a few minutes there was renewal of severe vomiting and convulsions, and the patient became unconscious; the pulse failed, and death ensued at 9 p.m., without return of consciousness, five hours after the administration of the fatal dose. On post-mortem examination, the viscera were unusually charged with blood, and there was considerable hyperæmia of the stomach and small intestines, so that the colon and rectum appeared pale and bloodless by contrast. The intestines contained fæces, there having been no stool passed during the illness; and the bladder contained two ounces and a half of urine.

In these cases it was intended to give Friedländer's nitrate of aconitine—a weak German preparation. The dispenser used instead a crystallized preparation procured from Petit, in Paris. Plugge, to whom the analysis was referred, found that Petit's preparation was eight times more poisonous to animals than Merck's, and 170 times stronger than Friedländer's nitrate. He failed to detect aconitine in a benzene extract of the viscera.

Alarming results have also been known to result from the administration of pills, each containing 1-250th of a grain of aconitine, four times a day. The symptoms were developed on the second day. ('Lancet,' 1880, ii. p. 46.)

In 1882 a medical practitioner named Lamson was tried, convicted, and executed for the murder of his brother-in-law, Percy Malcolm John. (*Reg.* v. *Lamson*, C. C. C., March, 1882.) This is the only known case of the homicidal use of *aconitine;* and the only recorded case of fatal poisoning by English (Morson's) aconitine. On Dec. 3, 1881, Lamson, a medical practitioner, visited his brother-in-law, æt. 19, who was at a school in Wimbledon. John, though a cripple, and paralysed below the pelvic region, was in good health at that time. In the presence of the master, Lamson gave to John a gelatine capsule, which he pretended to fill with sugar, but into which he had no doubt introduced a fatal dose of aconitine —perhaps the whole of two grains, which he had purchased a few days previously. This was done under the pretence of showing the youth how to use the capsules for taking nauseous medicines. Lamson then made a hasty departure. Twenty minutes or half an hour after swallowing the capsule, the victim was seized with pain in the stomach, which he at first called heartburn, and which he compared to pain which he had experienced on a former occasion, when Lamson had given him what professed to be a quinine pill or powder. In a box belonging to John there was found, after his death, a packet of quinine powders, some of which were mixed with aconitine, whilst others were free from that poison; and also pills containing quinine and aconitine. There is no doubt that attempts had been made on John's life on two previous occasions, by the administration of these articles furnished to his brother-in-law by Lamson. The boy was taken upstairs, and he vomited, and was in great pain. He said his skin felt all drawn up, and that his throat burned. When seen by Berry, one hour and forty minutes after the administration of the poison, he was lying on the bed, with great pain in the stomach. He complained of the skin of his face being drawn, of a sense of constriction in the throat, and of being unable to swallow. He retched violently, and vomited a small quantity of dark-brown fluid. Half an hour later he was also seen by Little, and two hours and three quarters after the poison was swallowed, a quarter of a grain of morphine was injected beneath the skin. This somewhat eased the patient's agony; but the symptoms returned with increased severity. At one time he was with difficulty kept lying down by the united force of two men. An hour later the morphine injection was repeated—one-sixth of a grain being used. Twenty minutes later he died, having been conscious almost to the last. Death occurred four hours and five minutes after the administration of the capsule, and not quite four hours after the commencement of symptoms. At the post-mortem examination, made by Bond, the only unusual appearances were —redness and inflammation of the cardiac end of the stomach, which had a blistered appearance; great congestion of the first portion of the small intestine (duodenum), and patches of congestion in other portions of the intestine in a lesser degree. The brain was hyperæmic. The membranes of the spinal cord were congested. The lungs were much congested, more especially towards the posterior parts. The heart was very flaccid, as if sodden, and stained with blood pigment. From a portion of the first ejected vomit, from the urine drawn off from the bladder after death, and from the stomach, stomach contents, liver, spleen, and one kidney, taken together, the editor and Dupré extracted aconitine by a modification of Stas's process. The existence of this was proved by its general reactions as an alkaloid, by the peculiar sensation which it excited upon the tongue, and by comparison of its fatal effects upon mice with those produced by Morson's aconitine. The 1-2000th part of a grain of English aconitine may be recognized by the taste-test, and the same quantity will kill a mouse within a few minutes.

A solitary case of poisoning with German aconitine (Merck's) is very crudely recorded. An analytical chemist took eight grains of aconitine after dinner, with suicidal intent. Half an hour later the first violent symptoms appeared. A burning sensation in the mouth and throat first made itself felt, and this became more intense every minute; intense pains in the stomach ensued after thirty minutes, and these became so violent in a few seconds that the patient writhed, shrieking in the most dreadful convulsions, and trying to strike the wall with his head. He was held with difficulty, and milk and oil were given. Very soon he became incapable of swallowing; he was seized with spasmodic cough, and wanted to vomit. In spite of emetics, he could not vomit, however, until an hour after taking the poison, and then, with great exertion, a dark greenish fluid was ejected; but this afforded no relief to the pain in the stomach, and the burning sensation in the throat, which rendered swallowing difficult. The application of the stomach-pump afforded no relief. Exhaustion ensued after violent convulsions, and the symptoms reappeared with renewed force. At the beginning of the third hour the pains and convulsions attained such violence that death was expected every instant. In the fourth hour, after repeated injections of morphine, the patient seemed somewhat better. Previous to this he indicated that his skin was greatly irritated. This irritation of the skin, as of ants crawling, continued apparently the whole time, and, whenever the intensity of the pains somewhat remitted, he scratched the skin of the face and breast in a convulsive manner, till these were sore. His eyes glared wildly, sometimes resting with a fixed stare on one point. The convulsions were repeated at almost regular intervals, and the inclination to vomit continued, although vomiting did not continue after the second hour. At intervals of about forty minutes, the patient seemed to lose consciousness, but only for a few minutes; and then the convulsions and the other symptoms reappeared with undiminished violence. Three hours after the onset of the symptoms, he became incapable of intelligible utterance, but indicated that he felt giddiness, and soon after he appeared to lose sight. He threw himself wildly about on the couch, screamed and uttered fearful groans. Exhaustion and apparent coma ensued, and then renewed attacks of the most violent description. Then difficulty of breathing set in, and he appeared to suffocate. At intervals he was conscious, indicated that he felt pain in the head and stomach, and was very thirsty. The pulse and body temperature fell considerably, and before death, which occurred at the end of twelve hours, exhaustion and unconsciousness set in, cold perspirations, and deathlike pallor. Though death from asphyxia was all along expected, this occurred from syncope. The post-mortem appearances showed nothing unusual. The pupils were dilated, the interior of the mouth was pale, the brain and lungs were congested, the valves of the heart were very flaccid, the liver and kidneys were congested. There was inflammation of the stomach, and its mucous membrane was congested (*sic*). The alkaloid was found by chemical analysis in the contents of the stomach; but, very remarkably, none was found in the urine of the deceased. ('Med. Press,' May 24, 1882, p. 439.)

Analysis.—Aconitine may be extracted from organic liquids by means of Stas's process for the separation of the alkaloids. In this way, and by applying the tests of taste and that of physiological action on animals (mice) to the substance thus extracted, a very minute trace of aconitine may be detected. No other alkaloid produces the same sensation upon the tongue as the alkaloid, or mixture of alkaloids, known as aconitine. It yields the general reaction of the alkaloids, and a colour-test with sulphuric acid has been described. This colour-reaction is, however, valueless, as it does not succeed with pure aconitine, and is due to the presence of impurity. Aconitine readily decomposes when in alkaline solution; and hence it speedily disappears from liquids which remain alkaline, and can no longer be detected. The editor finds that its presence can no longer be detected in viscera where it was known to exist, should these become from putrefactive decomposition, and remain, alkaline for some time.

LABURNUM (CYTISUS LABURNUM).

Symptoms and Effects.—The *bark* and *seeds* of the common LABURNUM contain an active alkaloid, called *Cytisine.* A case of poisoning by the bark was the subject of a trial at Inverness. ('Edin. Med. and Surg. Jour.,' Oct. 1843.) A youth, with the intention of merely producing vomiting in one of his fellow-servants, a young woman, put some dry laburnum bark into the broth which was being prepared for their dinner. The cook, who remarked a 'strong peculiar taste' in the broth, soon became very ill, and in five minutes was attacked with violent vomiting. The account of the symptoms is imperfect, for the cause of them was not even suspected until six months afterwards. The vomiting continued thirty-six hours, was accompanied by shivering, pain in the abdomen, especially in the stomach, great feebleness, and severe purging. These symptoms continued, more or less, for a period of eight months; and the woman fell off in flesh and strength. At this time she was seen by a physician, who had been called on to investigate the case. She was then suffering from gastro-intestinal irritation, vomiting after food, pain in the abdomen increased by pressure, purging, tenesmus, and bloody evacuations, with other serious symptoms. The medical opinion was that she was in a highly dangerous state. The woman eventually recovered. There was no doubt, from the investigation made by Ross and Christison, that her protracted illness was really due to the noxious effect of laburnum bark. A girl, æt. 18, idly and unthinkingly put a small portion of a laburnum branch into her mouth, carrying it for some hours, and chewing it. It was described as of the thickness of the little finger, and two or three inches long. There were some yellow flowers with it, but she was not aware that she had swallowed any. In about half an hour she felt unwell, but she was not seen by a medical man until the day following. The symptoms then were great pain in the stomach, nausea and retching, but no vomiting; pulse 100, tongue white, great thirst, anxiety and pallor of countenance, dilated pupils, sense of fainting even while lying down, and great exhaustion. There was no purging. Under treatment these symptoms disappeared, and the girl recovered in about a fortnight. ('Lancet,' 1870, ii. p. 182.)

In reference to poisoning with the *seeds* of laburnum, there are many instances recorded.

In 1882 two fatal cases of poisoning occurred with some undetermined portions of the laburnum tree. ('Brit. Med. Jour.,' 1882, i. p. 199.) The victims were two children, aged respectively three and eight years. The elder child was seized with vomiting and diarrhœa, headache, and prostration. In six hours the vomiting and diarrhœa ceased. She then made noises in her breathing, and continued in much the same state till her death, fourteen hours after she was attacked. Next day the younger child became tired and sleepy, vomited, and complained of headache. She vomited freely and passed two motions. Five hours and a half after the commencement of the symptoms she was convulsed, and the convulsions continued till her death, eight hours from the commencement of the attack. On post-mortem examinations being made, some signs of irritation of the stomach and intestines were observed in each case. The contents of the stomachs of both children were examined by the eye and by the microscope, but no fragments of the structures of the laburnum were discovered. Good evidence was, however, obtained by Fairley, in both cases, of the presence of cytisine, the poisonous alkaloid present in the flowers, seeds, bark, leaves, and all parts of the common laburnum tree. A small portion of an alcoholic extract, made from the stomach and contents of the elder child, was administered to a mouse, which died in the course of a few hours.

The *flowers* of this plant are highly noxious. A child, between three and four years of age, ate twelve laburnum flowers, and in about fifteen minutes it complained of sickness and severe pain in the stomach. The child vomited a quantity of mucus mixed with the yellow petals of the laburnum. An emetic was given: this cleared the stomach, and the child recovered. There was no purging. ('Guy's Hosp. Rep.,' 1850, p. 219.) In a recent case a great diminution of the temperature of the body was noticed. The child recovered. ('Brit. Med. Jour.,' 1883, i. p. 1117.)

Analysis.—The poisonous principle of the laburnum is *Cytisine.* It is difficult of separation, and at present has no well-defined chemical properties, except its insolubility, whereby it may be identified. Hence, when administered in powder, infusion, or decoction, there are no chemical processes known by which the poison may be detected. *Cytisine* is an alkaloid, having a bitter taste, and is distinguished from many other alkaloids by its insolubility in ether, chloroform, benzene, and carbon disulphide.

WOUNDS AND PERSONAL INJURIES.

CHAPTER 23.

DEFINITION OF A WOUND.—DANGER TO LIFE.—GRIEVOUS BODILY HARM.—EXAMINATION OF WOUNDS.—DESCRIPTION OF WOUNDS.—CHARACTERS OF WOUNDS INFLICTED ON THE LIVING AND DEAD BODY.—ECCHYMOSIS IN THE LIVING AND DEAD.—EFFECTS OF VIOLENCE ON THE DEAD BODY.—ECCHYMOSIS NOT ALWAYS A RESULT OF VIOLENCE.

Definition.—In a medico-legal sense, a wound implies a breach of continuity in the structures of the body, whether external or internal, suddenly occasioned by mechanical violence. The definition therefore includes injuries to the skin or mucous membrane of the outlets of the body—dislocations and fractures, whether simple or compound, as well as ruptures of the viscera. In a medical point of view, a wound is commonly restricted to those *external* injuries in which the skin is implicated; but in legal medicine the term has a much wider signification.

Danger to Life.—When a wound has been criminally inflicted on a person by the wilful act of another, one of the first questions which presents itself for consideration is how far the injury is dangerous to life. In order to justify the detention of the accused, a magistrate may require a medical opinion or a written statement from the surgeon in attendance. The meaning of the words '*dangerous to life*' is left entirely to the professional knowledge of a witness. It is not sufficient on these occasions that he should make a naked declaration of the wound being dangerous to life; he must, if called upon, state to the court satisfactory reasons for his opinion; and these reasons are rigorously inquired into by counsel for the defence. As a general principle, it would not be proper to consider those wounds dangerous to life in which the danger is not *imminent*. A wound of a great blood-vessel, of any of the viscera, or a compound fracture with depression of the bones of the head, must in all instances be regarded as bodily injuries dangerous to life; because in such cases the danger is imminent. Unless timely assistance be rendered, these injuries will most probably prove fatal, and, indeed, they often destroy life in spite of the best surgical treatment. When, however, the danger is remote—as in a puncture or laceration of the hand or foot, which may be followed by tetanus—or in a laceration of the scalp, which may be followed by erysipelas—or in penetrating wounds of the orbit, which may be attended by fatal inflammation of the brain or its membranes—the case is somewhat different. Such injuries as these are not directly dangerous to life—they are only liable to be attended with danger in certain cases and under certain circumstances; hence the medical opinion must be qualified. The law, on these occasions, appears to contemplate the direct and not the future or merely possible occurrence of danger; if the last view were adopted, it is clear that the most trivial lacerations and punctures might be pronounced dangerous to life, since tetanus or erysipelas, proving fatal, has been an occasional consequence of very slight injuries. A difference of opinion will often exist among medical witnesses whether a particular wound is or is not dangerous to life. Unanimity can only be expected when the judgment and experience of the witnesses are equal. The rules for forming an opinion in these cases will, perhaps, be best deduced from the results of the observations of good surgical authorities in relation to injuries of different parts of the body.

Wounds causing grievous bodily harm.—A wound may not be dangerous to life, but it may have produced '*grievous bodily harm.*' This question is sometimes put, although the usual practice is to leave it to be drawn by the jury as an inference from a professional description of the injury. The words have a vague signification; but it would, perhaps, be difficult to substitute for them others less open to criticism. They evidently refer to a minor description of offence, and are applied commonly to those injuries which, while they do not actually place life in danger, may be attended with considerable personal inconvenience, or be in some way detrimental to the health of the wounded person. Pollock, C.B., stated on one occasion that 'grievous bodily harm' would reasonably apply to such an injury as would render medical treatment necessary. It is always a question for a jury whether the *intent* of the prisoner, in inflicting a wound, was or was not to produce grievous bodily harm. In some cases the nature or the situation of a wound, as well as the kind of weapon used, will at once explain the intent: so far the medical witness may assist the court by giving a plain description of the injury, as well as of the consequences with which it is usually attended. It may happen either that the wound itself is not of a serious nature, and yet the intention of a prisoner may have been to do grievous bodily harm to the wounded person; or the injury may be really serious, and yet the prisoner may not have intended to do grievous bodily harm. On a trial for manslaughter (C. C. C., April, 1873), Cleasby, B., made the following legal distinction between a simple wounding and wounding with intent to do grievous bodily harm: There was, he said, no proof as to the instrument, if any, with which the wound was inflicted. The injuries were certainly serious, and it would be for the jury to say whether they were done with the intention to inflict grievous bodily harm. The intention, as it happened in this case, could only be inferred from the injury which really was done. Possibly the prisoner inflicted more than he really intended.

Let us suppose that the wounded person is found dead, and an examination of the body is required to be made. The most difficult part of the duty of a medical jurist now commences. Among the numerous questions which here present themselves, the first which demands examination is whether the wound was inflicted on the body before or after death.

Examination of Wounds.—In examining a wound on a dead body, its situation, extent, length, breadth, depth, and direction should be observed; whether there is about it effused blood, either liquid or coagulated; and whether there is ecchymosis, *i.e.* a livid discoloration of the skin from the effused blood. It should also be ascertained whether the surrounding parts are swollen, whether adhesive matter or pus is effused, whether the edges of the wound are gangrenous, or any foreign substances are present in it. Care must be taken that putrefaction is not mistaken for a gangrenous condition of the wound. The wound may be examined by gently introducing into it a bougie, and carrying on the dissection around this instrument, avoiding as much as possible any interference with the external appearances. The preservation of the external form will allow of a comparison being made at any future time between the edges of a wound and a weapon found on a suspected person. Of all these points *notes* should be taken, either on the spot or immediately afterwards. In the dissection, every muscle, vessel, nerve, or organ involved in the injury should be traced and described. This will enable a witness to answer many collateral questions that may unexpectedly arise during the inquiry. Another point should be especially attended to. A medical man has frequently contented himself with confining his dissection to the injured part, thinking that, on the trial of the accused, the questions of counsel would be limited to the situation and extent of the wound only; but this is a serious mistake. If the cause of death be at all obscure, on no account should the inspection be abandoned until all the important organs and cavities of the body have been closely examined; since it may be affirmed that a natural cause of death might have existed in that organ or cavity which the medical witness had neglected to examine. It rests with the practitioner to disprove the probability thus urged by counsel. In the medical reports on the examination of the bodies of wounded persons, care should be taken to avoid the introduction of any remarks in the form of inferences from the facts of the case (*ante*, p. 12). The *facts* should be simply recorded, and the inferences or comments reserved for evidence at the inquest or trial. In making an inspection of the wounded body, the stomach should not be overlooked. Death may have been apparently caused by violence, and yet really be due to poison of which a portion may be found in the stomach or bowels.

Description of Wounds.—It is impossible to impress too strongly on the mind of a medical witness that, in describing the wounds which he has found on the examination of a body, he should employ plain and simple language, and avoid as much as possible the use of technical or professional terms. The natural desire of a good witness is to make himself understood; but this cannot be accomplished if he clothes his ideas in language which is incomprehensible to educated men of the legal profession, and *à fortiori* to the class of men who constitute common juries. There are few assizes which do not afford many illustrations of the injury done to scientific evidence, and the clear understanding of a case, by the technical language in which it is given. A medical witness should, for his own credit and for that of the profession to which he belongs, employ plain and simple language in describing a wound, as well as in giving his evidence generally (see p. 33).

Characters of a Wound inflicted during Life.—If we find about a wound marks of gangrene, the effusion of adhesive or purulent matter, or if the edges are swollen and enlarged, and cicatrization has commenced, it is not only certain that the injury must have been inflicted before death, but that the person must have lived some time after it was inflicted. Marks of this description will not, however, be commonly found when death has taken place within ten or twelve hours from the infliction of the injury. A wound which proves fatal within this period of time will present throughout much the same characters. Thus, supposing it to have been clean-cut, or *incised,* there will be traces of more or less bleeding, the blood having chiefly an arterial character, and it will be found coagulated where it has fallen on surrounding bodies. The edges of the wound are everted, and the muscular and cellular tissues around are deeply reddened by effused blood. Coagula, or clots, are found adhering to the wound, provided it has not been interfered with. The principal characters of a wound inflicted during life are, then, the following:—1. Eversion of the edges owing to vital elasticity of the skin. 2. Abundant hæmorrhage or bleeding, often of an arterial character, with general diffusion of blood in the surrounding parts. 3. The presence of clots. The wound may not have involved any vessel, and there may be no appearance of bleeding; still the edges will be everted, and the muscles and skin retracted. By an observation of this kind made on the body of a new-born child (case of *Elphick*, March, 1848), Prince was enabled to state that the child was living when the wound was inflicted, an opinion afterwards confirmed by the confession of the mother.

Characters of a Wound made after Death.—If the wound on a dead body be not made until twelve or fourteen hours have elapsed from the time of death, it cannot be easily mistaken for one produced during life. Either no blood is effused or this is of a venous character, *i.e.* it may have proceeded from some divided vein. The blood is commonly liquid, and does not readily coagulate as it falls on surrounding bodies, like that poured out of a wound in the living. The edges are soft, yielding, and destitute of elasticity; they are therefore in close approximation. The cellular and muscular tissues around are either not infiltrated with blood, or only to a very partial extent. There are no coagula, or clots, within the wound. In experimenting upon amputated limbs, the author found these characters possessed by a wound produced two or three hours after death, although they are best seen when the wound is not made until after the body has lost all its animal heat. In wounds on the dead body, divided arteries have no marks of bleeding about them, while in the living body the fatal bleeding commonly proceeds from these vessels. Hence in a wound on the living, it will be found that the surrounding vessels are empty. The absence of spirting of arterial blood may be of importance in determining whether one of two or more fatal wounds was first inflicted. (*Reg.* v. *Lee,* Exeter Ass., Feb. 1885.) The chief characters of a wound after death are, therefore:—1. Absence of copious bleeding. 2. If there is bleeding, it is exclusively venous. 3. The edges of the wound are close, not everted. 4. There is no diffusion of blood in the cellular tissue. 5. There is an absence of coagula. But it may happen that a wound has been inflicted soon after the breath has left the body, and while it was yet warm. The distinction between a wound then made and one made during life is not so well marked as in wounds inflicted at a later period after death.

In any case in which it is doubtful whether a wound was inflicted on a living or dead body, we should be cautious in giving an opinion; since it must be remembered there are no decisive characters by which wounds of the kind referred to can be distinguished, and a medical witness is as likely to be wrong as right in selecting either hypothesis. It is a considerable step in evidence when we are able to assert that a particular wound, found on a dead body, must have been inflicted either during life or *immediately* after death; for it can scarcely be supposed that, in a case calling for criminal investigation, any one but a murderer would think of inflicting upon a body immediately after death a wound which would assuredly have produced fatal effects had the same person received it while living. So soon as such an opinion can be safely expressed by a witness, circumstantial evidence will often make up for that which may be, medically speaking, a matter of uncertainty.

Wounds or Injuries unattended with Hæmorrhage.—The copious effusion of blood has been set down as a well-marked character of a severe wound received during life; but this observation applies chiefly to cuts and stabs. Lacerated and contused wounds of a severe kind are not usually accompanied with much bleeding, even when a large blood-vessel is implicated. It is well known that a whole member has been torn from the living body, and that little blood has been lost; but in such cases coagula, or clots of blood, are commonly found adhering to the separated parts—a character which indicates that the wound was inflicted either during life or soon after death, while the blood was warm and fluid. When a lacerated or contused wound involves a highly vascular part, although no large blood-vessel may be implicated, it is liable to cause death by loss of blood.

Ecchymosis from Violence.—Contusions and contused wounds are commonly accompanied by a discoloration of the surrounding skin, to which the term ecchymosis (ἐκχύω, to pour out) is applied. This consists essentially in the extravasation or effusion of blood generally from small ruptured vessels, into the surrounding cellular tissue beneath the skin. An ecchymosis is commonly superficial, affecting only the layers of the skin, and showing itself externally, either immediately or in the course of a short time, in the form of a deep-blue or livid red patch; but the effusion may be so deeply seated as not to produce any external discoloration of the skin.

Violence inflicted on a living body may not show itself under the form of ecchymosis until *after death.* A man received several kicks on the lower part of his abdomen, which caused a rupture of the bladder, and death by peritonitis, in about thirty-five hours; but there was no ecchymosis in the seat of the blows, *i.e.* in the pubic and lumbar regions, until after death. Hinze met with a case of suicidal hanging, in which it was observed that ecchymosis appeared in the course of the cord only after death. This is not uncommon. (See Hanging.) It has been remarked by Devergie that ecchymoses are often concealed on the bodies of the drowned, when first removed from water, owing to the sodden state of the skin; and they may become apparent only after the body has been exposed for some days, when the water has evaporated.

A medical jurist must guard against the error of supposing that, when a blow has been inflicted on a living person, it is necessary that the individual who is maltreated should survive for a long period in order that ecchymosis may be produced. Among numerous instances proving the contrary, the case of the *Duchesse de Praslin* (1847) may be mentioned. This lady, who was assassinated by her husband, was attacked while asleep in bed. The number of wounds on her person (thirty) showed that there had been a mortal struggle, which, however, could not have lasted more than *half an hour.* Yet, on inspection, there were the marks of numerous ecchymoses, which had resulted from the violent use of a bruising instrument. ('Ann. d'Hyg.,' 1847, t. 2, p. 377.) Casper considered that ecchymosis required a certain time for its production, and that, if a person died speedily from the effects of violence, no ecchymosis would be found on the body, although the violence might have been of a bruising nature. The case of the Duchesse de Praslin shows that this is not correct, and Casper himself has admitted that ecchymosis may be produced as the result of violence applied to a recently dead body (see Strangulation, *post*)—a result which is in accordance with other facts mentioned above; but if ecchymosis can be produced by violence to the recently dead, it is clear that a continuance of active life is not necessary for its production. The following case shows how these facts may be misapplied. A young man was seen to strike one of his companions. The person struck died suddenly. On a post-mortem examination, the mark of a bruise was seen over the sixth and seventh ribs on the right side. About a fortnight before this blow was struck, the deceased had met with an accident—a heavy box fell on his right side, knocked him senseless, and nearly killed him. The question at issue was, whether the ecchymosed mark on the side was owing to the blow struck shortly before the man died, or to the fall of the box upon his body a fortnight previously. It was suggested, on the authority of Casper, that, as the man died soon after the blow was struck, the ecchymosis could not have arisen from the blow, but that it was most probably due to the fall of the box a fortnight before. ('Lancet,' 1870, vol. 2, p. 35.) Such a case does not present much difficulty. If the ecchymosed mark was blue or livid, and without any marginal colours, it was probably the result of the blow struck just before death. If the blood is fluid at the time of violence, and the small capillary vessels are torn through—sudden death following—a blow may cause the effusion of blood, and the production of a mark on the skin. The warm liquid blood thus effused will find its way into the cellular tissue, and produce the usual external appearance. If in the case quoted the ecchymosis had been produced a fortnight before, it would have shown some changes of colour at the margin, as described in the next paragraph.

The changes which take place in the colour of an ecchymosed spot are worthy of attention, since they may serve to aid the witness in giving an opinion on the probable time at which a contusion has been inflicted. After a time, commonly in eighteen or twenty-four hours, the blue or livid margin of the spot is observed to become lighter; it acquires a violet tint, and before its final disappearance it passes successively through shades of a green, yellow, and lemon colour. During this time the spot is much increased in extent, but the central portion of the ecchymosis, that part which received the violence, is always darker than the circumference.

Contusions on the Dead.—Christison found that blows inflicted on a dead body within *two hours* after death gave rise to appearances on the skin similar to those which resulted from blows inflicted on a person shortly before death. The livid discoloration thus produced generally arose from an effusion of the thinnest possible layer of the fluid part of the blood on the outer surface of the true skin, but sometimes also from an effusion of blood into a perceptible stratum of the true skin itself. He likewise found that dark fluid blood might even be effused into the cellular tissue in the seat of the discolorations, so as to blacken or redden the membranous partitions of the cells containing the fat; but this last effusion was never extensive. From this, then, it follows that, by trusting to external appearances only, contusions made soon after death may be easily confounded with those which have been produced by violence shortly before death. If a contusion has been caused some hours before death, there will be swelling of the part, and probably also changes of colour in the ecchymosed patch, in either of which cases there will be no difficulty in forming an opinion. Although ecchymosis, or an appearance similar to it, may be produced on a body after death, the changes in colour are then met with only under peculiar circumstances, as where the person is labouring under general dropsy, and the serum effused beneath the skin may lead to the diffusion of the blood. The most satisfactory mark of distinction between the effects of blows on the living and dead body, in the opinion of Christison, is the following: in a contusion inflicted during life, the ecchymosed portion of cutis (true skin) is generally dark and much discoloured from the infiltration of blood throughout its whole thickness; the skin at the same time is increased in firmness and tenacity. This is not, however, a uniform consequence of a contusion during life; for a blow may cause effusion of blood beneath the skin without affecting the cutis in the manner stated. The state of the skin here described cannot be produced by a contusion on a dead body; although it is still an open question whether it might not be produced if the contusion were inflicted a *few minutes* after death. As it is, the value of this sign is somewhat circumscribed: it is not always produced on the living,—it might be possibly produced on the recently dead; so that when it does not exist we must look for other differential marks, and when it does exist we ought to satisfy ourselves that the contusion was not inflicted recently after death.

The period at which such injuries cease to resemble each other has not been fixed with any degree of precision; but, as in the case of incised wounds, it would seem that there is little danger of confounding them, when a contusion has not been inflicted on a *dead* body until after the disappearance of animal heat and the commencement of rigor mortis.

The practical inference from these observations is that discolorations of the skin, caused by blows inflicted soon after death, may be sometimes mistaken for marks of violence on the living body. An instance has been communicated to the author in which, for the sake of experiment, blows with a stick were inflicted on the recently dead body of a woman, while still warm. The body was afterwards accidentally seen by non-professional persons, who were not aware of the performance of these experiments; and so strong was the impression from the appearances that the deceased had been maltreated during life, that a judicial inquiry was actually instituted, when the circumstances were satisfactorily explained. The fact, therefore, that *severe* blows after death resemble *slight* blows during life, is of some importance; there is ecchymosis in each case, and no certain method of distinguishing the one from the other.

Is Ecchymosis a necessary result of violence?—This medico-legal question has often created great difficulty. It has been repeatedly asserted in courts of law that no severe blow could have been inflicted on the body of a person found dead, in consequence of the absence of ecchymosis or other indication of violence on the part struck; but this assertion is entirely opposed to well-ascertained facts. However true the statement may be that severe contusions are commonly followed by ecchymosis, it is open to numerous exceptions; and unless these are known to a practitioner, his evidence may mislead the court. The presence of ecchymosis is commonly presumptive evidence of the infliction of violence, but its absence does not necessarily negative this presumption.

It was long since remarked by Portal that the spleen had been found ruptured from blows or falls, without any ecchymosis or abrasion of the skin appearing in the region struck. This has been also observed in respect to ruptures of the stomach, intestines, and urinary bladder, from violence directly applied to the abdomen. Portal supposed that the mechanical impulse was simply transferred through the supple parietes (or walls) of the abdomen to the viscera behind, as in the striking of a bladder filled with water. Whether this be the true explanation or not, it is quite certain that the small vessels of the skin often escape rupture from a sudden blow, so that their contents are not effused. A case is reported by Henke, in which a labouring man died some hours after fighting with another, and on an inspection of the body the peritoneum was found extensively inflamed, owing to an escape of the contents of the small intestines, which had been ruptured to a considerable extent. There was, however, no ecchymosis or mark on the skin externally, and the medical inspectors were inclined to affirm, contrary in this case to direct evidence, that no blow could have been struck; but others of greater experience were appealed to, who at once admitted that the laceration of the intestines might have been caused by a blow, even although there was no appearance of violence externally. Watson states that a girl, aged nine, received a smart blow upon the abdomen from a stone. She immediately complained of great pain; collapse ensued, and she died in twenty-one hours. On inspection there was no mark of injury externally, but the ileum (small intestines) was found ruptured, its contents extravasated, and the peritoneum extensively inflamed. ('On Homicide,' p. 187.) Williamson met with a case in which a man received a kick on the abdomen from a horse: he died in thirty hours from peritonitis. The ileum was found to have been torn completely across in its lower third. There was not the slightest trace of ecchymosis externally—a fact which is the more remarkable since the blow was here struck by a somewhat angular or pointed body, the hoof of a horse. ('Med. Gaz.,' May, 1840. See also 'Guy's Hosp. Rep.,' 1865, p. 285.) A man who had been run over by an omnibus was brought into hospital. The wheel had gone over his chest and abdomen, but on admission no injury was discoverable. On the second day peritonitis set in, from which he rapidly sank. The liver and the small intestines were found ruptured. ('Guy's Hosp. Gaz.,' 1873.) Many other cases might be adduced in support of the statement that ecchymosis is not a necessary or constant result of a severe blow or severe bruising violence; but these sufficiently establish the fact. This medico-legal question frequently arises in cases in which the bladder or liver is ruptured, as, owing to the general absence of marks of violence, it is often alleged in defence that no blow or kick could have been inflicted on this part of the abdomen. It is unnecessary to say that this view is not in accordance with facts. (See Ruptures of the heart, liver, spine, and intestines, *post.*)

CHAPTER 24.

EVIDENCE OF THE USE OF A WEAPON.—CHARACTERS OF WOUNDS CAUSED BY WEAPONS.—INCISED, PUNCTURED, LACERATED, AND CONTUSED WOUNDS.—STABS AND CUTS.—WHAT ARE WEAPONS?—EXAMINATION OF THE DRESS.—IMPUTED OR SELF-INFLICTED WOUNDS.

Evidence of the Use of a Weapon.—It is not necessary to prove that a weapon has been used for the production of a wound, for the words of the statute are: 'Whosoever shall, *by any means whatsoever*, wound or cause any grievous bodily harm to a person,' etc.; yet evidence of the use of a weapon in cases of assault may materially affect the amount of punishment awarded on conviction. When, upon the clearest evidence, it is certain that a weapon has been used, it is not unusual for prisoners to declare that no weapon was employed by them, but that the wound had been occasioned by accidental circumstances. A witness should remember that he is seldom in a position to swear that a particular weapon produced at a trial must have been used by the prisoner: he is only justified in saying that the wound was caused either by it or by one similar to it. (*Reg.* v. *Goodale*, Lincoln Aut. Ass., 1885.) Schwörer relates the following case. A man was stabbed by another in the face, and a knife with the blade entire was brought forward as circumstantial evidence against him, the surgeon having stated that the wound had been caused by *this* knife. The wounded person recovered; but a year afterwards an abscess formed in his face, and the broken point of the real weapon was discharged from it. The wound could not, therefore, have been produced by the knife which was brought forward as evidence against the prisoner at the trial. ('Lehre von dem Kindermorde.') Although the criminality of an act is not affected by an occurrence of this kind, it is advisable that such mistakes should be avoided by the use of proper caution on the part of a witness. (On this question, see the case of *Renaud*, by Boys de Loury, 'Ann. d'Hyg.,' 1839, t. 11, p. 170. As to what is a weapon, see Henke, 'Zeitschrift der S. A.,' 1844, vol. 1, p. 67.)

Characters of Wounds produced by Weapons.—Let us now suppose that no weapon is discovered, and that the opinion of a witness is to be founded only on an examination of a wound. It is right for him to know that, on all criminal trials, considerable importance is attached by the law to the fact of a wound having been caused by the use of a weapon; since this generally implies malice, and in most cases a greater desire to injure the party assailed than the mere employment of manual force. Some wounds, such as cuts and stabs, at once indicate that they must have been produced by weapons.

1. *Incised Wounds.*—In incised wounds, the sharpness of the instrument may be inferred from the cleanness and regularity with which the edges are cut; in stabs, also, the form and depth of a wound will often indicate the kind of weapon employed. Stabs sometimes have

the characters of incised punctures, one or both extremities of the wound being cleanly cut, according to whether the weapon is single or double-edged. Dupuytren has remarked that such stabs, owing to the elasticity of the skin, are apparently smaller than the weapon—a point to be remembered in instituting a comparison between the size of a wound and the instrument. A lateral motion of the weapon may, however, cause a considerable enlargement of the wound. (See case 'Ann. d'Hyg.,' 1847, t. 1, p. 400.) When a stab has traversed the body, the aperture of entrance is commonly larger than that of exit; and its edges, contrary to what might be supposed, are sometimes everted, owing to the rapid withdrawal of the instrument. That facts of this kind should be available as evidence, it is necessary that the body should be seen soon after the infliction of a wound, and before there has been any interference with it.

In general, wounds made by *glass or earthenware* are characterized by their great irregularity and the unevenness of their edges. In *Reg.* v. *Ankers* (Warwick Lent Ass., 1845), a clean cut as from a penknife, about two inches long and one deep, was proved to have existed on the person of the wounded man, who had fallen during a quarrel with the prisoner. Some broken crockery was lying near the spot, and it was alleged in the defence that a fall upon this had caused the wound. This allegation was quite inconsistent with the clean and even appearance of the edges of the wound. The prisoner, in whose possession a penknife had been found, was convicted.

2. *Punctured Wounds.*—It is necessary to notice whether the edges of a punctured wound are lacerated and irregular, or incised; because it may be alleged, in defence, that the wound was produced by a fall on some substance capable of causing an injury somewhat resembling it. In a case that occurred to Watson, a deeply-penetrating wound on the genital organs of the deceased, which had evidently caused the woman's death, was ascribed, by the prisoners charged with the murder, to her having fallen on some broken glass; but it was proved that the edges of the wound were bounded everywhere by clean incisions, which rendered this defence inconsistent, if not impossible. A similar defence has been made on other occasions, where the cases came to trial. In general, wounds made by *glass or earthenware* are characterized by their great irregularity and the unevenness of their edges, with portions of the substance in them. Cases of this kind show that, as it is not always possible to know when this sort of defence may be raised, a medical witness should never fail to make a *minute examination* of a wound which is suspected to have been criminally inflicted. These medical difficulties are now for the most part removed by the 24 & 25 Vict., c. 100. This must not, however, lead the witness to suppose that a personal injury is not to be carefully examined with a view to the determination of this question.

3. *Lacerated and Contused Wounds.*—Lacerated wounds do not in general present greater difficulty with regard to their origin than those which are incised or punctured. The means which produced the laceration are commonly well indicated by the appearance of the

wound. These injuries are generally the result of accident; they are, however, frequently met with on the bodies of new-born children, in which case they may give rise to a charge of infanticide. If it could be proved that they had arisen from the use of a weapon, and that the weapon fitted the wounds, these facts would, of course, go far to a conviction on a charge of murder. In the case of *Montgomery* (Omagh Sum. Ass., 1873), it was proved that a bill-hook, found buried in a spot to which the prisoner was seen to go, fitted the injuries produced on the skull of the deceased, and this piece of evidence served to connect the prisoner and the weapon with the act of murder, which took place in a dwelling-house.

Contused wounds and severe contusions present much greater difficulty to a medical jurist. It is not often in his power to say whether a contused wound has resulted from the use of a weapon, from *a blow of the fist*, or *a fall*, by reason of the deceased having accidentally fallen against some hard surface. The question is frequently put to medical witnesses on those trials for manslaughter which arise out of the pugilistic combats of half-drunken men. One of the combatants is generally killed, either by a blow on the head, by a fall, or by both kinds of violence combined. The skull may or may not be fractured; and the person may die of concussion, inflammation of the brain, or from effusion of blood. The general defence is that the deceased struck his head against some hard substance in falling on the ground, and a surgeon is asked whether the particular appearances might not be explained on the supposition of a fall. A medical witness is rarely in a position to swear with certainty that a contused wound of the head must have been produced by a weapon and *not* by a fall. (*Reg.* v. *Budd*, Kingston Lent Ass., 1868.) Some circumstances, however, may occasionally enable him to form an opinion on this point. If there are contused wounds on several parts of the head, with copious effusion of blood beneath the skin, the presumption is that a weapon must have been used. If the marks of violence are on the summit of the head, it is highly probable that they have been caused by a weapon, since this is not commonly a part which can receive injury from a fall. So, if sand, gravel, grass, or other substances be found in a contused wound, this will render it highly probable that the injury was really caused by a fall.

It matters not, under the new statute on wounding, whether the wound was produced directly by a weapon employed by an assailant, or indirectly by any act of violence on his part. A man may fracture the skull of another, either by striking him with a brick, or by striking him with his fist and thus causing him to fall against a brick. Acquittals formerly took place upon technicalities of this kind ('Law Times,' March 21, 1846, p. 501); but in *Reg.* v. *Dodd* (Shrewsbury Sum. Ass., 1853) Coleridge, J., expressed a strong opinion against the distinction thus made. The prisoner, it was alleged, threw a stone at the deceased, who immediately fell on a stone floor. The deceased was able to go about for several days, but he died, a week after he had sustained the violence, from inflammation of the brain, as a result of fracture of the skull. The medical witness ascribed the fracture to a blow from a stone. In the defence, it was urged that the fracture might just as well have arisen from a fall on a stone floor. Coleridge, J., held, if the prisoner knocked the deceased down, that it would make no difference whether the deceased died from a fall on a stone floor or from an injury produced by the stone which was thrown at him.

A doubt may arise whether a *weapon* has or has not been used in reference to lacerated or contused wounds. Contused wounds on bony surfaces, as on the head (*e.g.*, the wound inflicted by the blow of a cricket-ball), sometimes present the appearance of incised wounds, the skin being evenly separated. When a wound is recent, a careful examination will generally enable a witness to form a correct opinion, but if some time has elapsed before a wound is examined, great caution will be required in forming a judgment.

In 1853, Hancock was enabled, by the careful examination of a wound, to disprove a charge of maliciously wounding made against innocent persons. A little girl was represented to have received, while sitting over an iron grating, a wound in the pudendum, by some persons pushing a toasting-fork, or other pointed instrument, between the bars of the grating from below. There were no marks of punctures, which would have been found had this statement been true, but a slight laceration of the parts, such as might have been produced by an accidental fall on the edge of the iron grating while the girl was in a sitting position. There were also marks of bruises on the thigh, such as might have occurred from an accident of this kind. The mother of the child had made a false charge for the sake of exciting public compassion and extorting money. A surgical examination of the injury clearly established that it had resulted from accident. The part of the body in which the injury existed in this case is not usually exposed to laceration or punctures from accident; but the child, for a necessary purpose, had placed herself voluntarily in this position, and had, on her own admission, slipped, and thus probably injured herself.

A surgeon should be cautious in listening to the statement of others, that a weapon has been used, unless the wound itself bears about it such characters as to leave the fact indisputable. During a scuffle, the person assaulted may be easily deceived as to the way in which an accused person inflicted a wound upon him; and a bad motive may sometimes exist for imputing to an assailant the use of a weapon during a quarrel. In such cases a medical witness should rather trust to the appearance of the wound for proof of the use of a weapon, than to any account given by interested parties.

A judge suggested to the author that some means of discrimination between the effects of falls and blows affecting the same part of the body would greatly aid the administration of justice. There is no doubt that it would, but as no two cases coming under this class of injuries are precisely alike, either in the part wounded or the amount of force employed, it is scarcely possible to introduce general rules or to make statistics practically available. It is commonly supposed that a mere fall is not sufficient to produce the same degree of injury that may be caused by a blunt weapon applied suddenly to the head by human force; but a severe fracture may arise from a simple accident of this kind, and present nearly all the characters of homicidal violence. The difficulties at criminal trials will be found to proceed, not so much from want of rules to assign the violence to one condition or the other, as from a want of observation when the wounds are first examined. If minute attention were given to an examination of these injuries soon after their occurrence, circumstances would be noticed which would help the medical witness to a conclusion. The defence that they might have been produced by a fall is not set up until a subsequent period, and the surgeon is then obliged to trust to his memory for the main points of distinction. Such improvised opinions usually fail in impressing a jury.

When it is a question which of two weapons produced certain bruised wounds found on the head, the difficulties of medical evidence are increased. Under these circumstances, the presence of blood, hair, cotton, or woollen fibres on one of the weapons, may render it probable that this weapon was used. (*Reg.* v. *Lee*, Exeter Ass., Feb. 1885.) In most instances an accurate observation of the form of a contused wound, and an early comparison of it with the alleged weapon, or the substance said to have produced it, will enable a witness to come to a correct conclusion on the subject. The situation, depth, and shape of the wound may be such that no accidental fall could reasonably account for its production. In assaults on women, it is not unusual to find that the complainant herself endeavours to exculpate the assailant by ascribing the marks of violence, not to blows, but to some accidental fall. A woman deposed before a magistrate that certain severe injuries which she had sustained had been caused by her falling on a fender. The medical man who examined her found on the top of the head three distinct wounds, which were bleeding. Two appeared as if they had been caused by a blunt instrument; the third, on the back of the head, was a clean-cut wound. He considered that they had been produced by a chopper, and that none of them had been caused by a fall or a series of falls. The prisoner, on this evidence, was committed for trial.

If the fall has taken place from a great height, as over a precipitous or rugged slope, it is obvious that the body may sustain many severe injuries to various parts quite sufficient to account for death. Such a fall may be the result of accident, of suicide, or, as in the case of *Madame de Tourville*, July, 1876, of a deliberate design to destroy life by pushing the person over the precipice. The injuries would be similar in each case. *De Tourville*, a barrister, was charged before the Austrian Court at Botzen with the murder of his wife by pushing her over a precipice in the Stelvio Pass. Her lifeless body was found at a considerable depth below. The chief seat of injury was the head, which had been crushed by the fall. There was nothing in the appearance of the body to show intentional violence. The guilt of the prisoner was made out by the false and inconsistent statements which he had made respecting the occurrence. There were marks of the body having been dragged some distance, and part of the dress, in a bloody state, was found at a distance from the spot where the body was lying, and there were marks of blood on the prisoner's hands and dress. After a lengthy trial, during which the spot was visited by the judge and jury, *De Tourville* was found guilty and sentenced to death. This sentence was subsequently commuted to imprisonment for life.

4. *Stabs and Cuts.*—It has been remarked that the law in some cases attaches great importance to the clear proof of the use of a *weapon;* and a medical man has therefore a certain responsibility thrown upon him when, in the absence of a weapon and the denial of its use, he is called upon to say whether one has or has not been used. In reference to cuts and stabs, there can in general be no difficulty, for these injuries carry with them distinct evidence of their mode of production. Formerly stabbing and cutting were treated as distinct from wounding, and very nice legal distinctions were drawn between these terms, which had the effect of procuring acquittals on mere legal technicalities. Under the consolidated Act, the words 'stab' and 'cut' are properly omitted, and the word 'wound' only has been retained. Medical men would always agree upon a stab or cut being a wound, but they might reasonably differ upon the question whether in a given case a wound was really a stab or a cut. It might be punctured, lacerated, or contused, and not fairly come under the professional description either of a cut or a stab. A medical witness has now only to prove that the personal injury falls strictly within the meaning of the term *wound* (p. 231); he is not called upon to prove the precise variety of wounding to which the injury should be assigned. At the same time, he should always be prepared with a full description of the characters of an injury in case questions on the subject should be put to him.

What are Weapons?—The consolidated statute has removed those legal subtleties which raised doubts on the true significance of the term *weapon.* Thus the teeth, the uncovered hands or feet, were formerly held by the judges *not* to be weapons; and injuries produced by them, however severe, were not treated as wounds within the meaning of statute. Persons were tried on charges of biting off fingers and noses, and although the medical evidence proved that wounds of a severe kind had been inflicted, and that great disfigurement and mischief had been done to individuals, yet the nature of the injury produced was not so much regarded as the actual method by which it was accomplished. The persons charged were acquitted under an indictment for 'wounding,' since wounds, in a legal sense, could be produced only by weapons, while the teeth, hands, and feet were not weapons in law.

Examination of the Dress.—This is sometimes a most important part of the duty of a medical man. In a case of severe wounding, of whatever kind, he should always require to see the dress of the wounded person. It may throw a material light upon the *mode* in which a wound has been produced; it may remove an erroneous suspicion of murder, and may sometimes serve to indicate that a wound has been self-inflicted, for the concealment of other crimes, or falsely to impute its infliction to other persons. Marks of blood, dirt, grass, or other substances on the clothing may also throw a light upon the mode of infliction. So again the use of a weapon, in reference to cuts and stabs, may be inferred from the dress presenting corresponding cuts or perforations. Contused wounds by bludgeons may, however, be readily produced through the dress, without tearing or injuring it. Considerable laceration of the skin and muscles, and even severe fractures, may be caused without necessarily penetrating the dress, supposing this to be at all of an elastic or yielding nature. In self-inflicted or imputed cuts or stabs, there is often a want of correspondence between the perforations of the dress and the wounds on the person: this is one of the characters by which the correctness of a statement may be tested. A severe wound may be indirectly produced by a bruising weapon, and medical witnesses have been often questioned on this point. Thus the prosecutor may at the time have worn about his person some article of dress which received the blow, and this may have actually caused the wound. Cases of this kind must be determined by the circumstances which accompany them. Hence it is obvious that a medical practitioner should always make a minute and careful examination of wounds which are likely to become the subject of criminal charges, as well as of the dress and clothing worn by the wounded person at the time of the assault. In performing his duties as a surgeon, he is bound, so far as he consistently can, to notice as a medical jurist the characters of all personal injuries, so as to be able to give an opinion on the mode in which they were produced. A careful examination of the dress has served to remove doubts respecting the mode in which contused wounds have been inflicted on the body of a person found dead; while, on the other hand, a neglect to examine the dress has led to accidental being mistaken for homicidal violence, as in the following case. A woman was found dead in bed. She had vomited slightly, and there was on the floor a small quantity of blood, which had flowed from the nose. She had been seen in her usual health on the previous night. There were found two indentations about the middle of the right parietal bone, and there was a large clot of blood in this situation beneath the skin. On removing this clot, the bone was found fractured to the extent of four inches. Nearly three ounces of clotted blood were found on the outer membrane of the brain (dura mater), between it and the skull. All the other viscera were healthy. This was the only injury, and quite sufficient to account for death; but a question arose respecting the mode in which this fracture was caused. It was in evidence that, on the evening before her death, the deceased had been knocked down, while she was walking in a public road, by a man accidentally running against her. One witness stated that she fell heavily on the back of her head, on which at the time she wore a bonnet. She appeared stunned—was raised up by the man—some brandy was given to her, and she recovered sufficiently to walk home and eat her supper as usual, after which no one saw her until she was found dead in bed on the following morning. Some suspicion arose that the violence done to the head was too great to be accounted for by a mere fall, and it was a question whether, with such an amount of injury, the deceased could have walked to her home, at the distance of a mile and a half, and have eaten her supper before going to bed. At first it was thought that this was a case of murder, and a man who lodged in the house with the deceased was suspected. His room was searched, and a hammer with two claws was found. On comparing these claws with the two indentations and fracture, the medical witness thought that this weapon would account for their production. The deceased and this man had been in the habit of quarrelling, and they were the only persons in the house on this occasion. The lodger said that he let the woman in about 9 p.m. (the fall in the road occurred about 7.30 p.m.); her appearance presented nothing unusual, and he saw no more of her until called at seven the next morning, when she was found dead and cold. It was only at the adjourned inquest that the *bonnet* worn by the deceased at the time of the fall was called for by the coroner. Two indentations were then found upon the back part of it, corresponding to those on the skull of deceased. The indentations on the bonnet contained dust and dirt, thereby confirming the statements of the witnesses, and rendering it probable that the fall in the road had really caused the fatal injury to the head. The examination of the dress in this case cleared up what might have been otherwise doubtful. It is probable that the large internal effusion of blood which had caused death did not take place until the deceased had reached home, and perhaps as a result of the exertion made. She must have died very soon after she went to bed, as her body was found cold at seven o'clock the next morning. In addition to the caution which this case conveys respecting medical opinions on the origin of wounds, it shows that persons may walk far, and die at a great distance from the spot where a serious injury to the head has been sustained.

If several wounds have been inflicted through the *dress*, an examination of this may sometimes suffice to show which was first received. A man, in struggling with an assailant, received three stabs with a knife—two on the left elbow and a third in the back. The latter was at about the level of the eighth rib; it was vertical to the chest and had clean edges. The lower margin wâs obtuse—the upper acute; hence it was evident that the cutting edge of the weapon had been directed upwards. It had traversed the left lung and the heart, and had caused immediate death. It was obvious, on examination, that this mortal wound had been first received, and the stabs at the elbow inflicted subsequently. These two stabs, which were slight, had divided the cloth coat and shirt, and had only grazed the skin, so that no blood had been effused. But the edge of the cuts in the cloth coat and shirt were stained with blood; hence it was evident that they must have been produced by a weapon already rendered bloody by a previous wound. The fact was of importance in the case, and the correctness of the medical opinion was confirmed by the evidence at the judicial inquiry. ('Ann. d'Hyg.,' 1847, p. 461.)

Imputed or Self-inflicted Wounds.—A man may produce upon himself one or more wounds for the purpose of simulating a homicidal assault which he may allege to have been committed upon him. With the motives for the self-infliction of wounds a medical jurist is not concerned—it is of the fact only that he can take cognizance. From cases that have occurred, it appears that the object has been to extort money, to conceal murder, robbery, or some other crime, and to turn away a suspicion of criminality from the wounded person himself; but it is not always easy to trace a motive for the self-infliction of injuries, and when a reasonable motive is not at once forthcoming, persons are apt to be misled and to credit the story. Persons who have been convicted of thus imputing violence to others have frequently borne good characters until the occurrence; and this has contributed to give support to their statements. When a person, intending to commit suicide, fails in the attempt, he has sometimes, under a sense of shame, attributed the infliction of a wound in his throat to another; but facts of this kind may without difficulty be cleared up by circumstantial evidence. Imputed wounds—if we except the case of an actual attempt at suicide, in which the injury is commonly severe—are generally of a *superficial* character, consisting of cuts or incisions not extending below the true skin; deep stabs are seldom resorted to where the purpose is not suicide, but merely to conceal other crimes. Further, these wounds are in *front* of the person, and may be on the right or left side, according to whether the person is right or left handed. They have also been generally *numerous*, and widely scattered; sometimes they have had a complete parallelism, unlike those which must have been inflicted by an adversary during a mortal conflict with a weapon. The *hands* are seldom wounded, although in the resistance to real homicidal attempts these parts commonly suffer most severely. The injuries are not usually situated over those parts of the body in which wounds are by common repute considered mortal, and there is in general an entire want of correspondence between the situation of the wounds on the person, and the cuts or other marks on the *dress*. This is a fact which requires special attention.

In comparing cuts on the *dress* with wounds on the person, there are several circumstances to be attended to. What articles of dress were worn at the time of the assault? In a case of actual stabbing by another, all ought to present marks of perforation, corresponding in direction, form, size, sharpness of the edges of the weapon, &c. In imputed wounds, the marks on several layers of dress may not correspond with each other in the characters above mentioned. It is difficult for a man simulating such injuries so to arrange his clothes when off his person as to deceive a careful examiner. There will be some inconsistency or want of adjustment. Apart from the fact that several stabs or cuts cannot exist on the same part of the clothes without one or more being stained with blood from the outside or inside. an impostor may either do too much or too little, and thus lead to his detection. In a case which excited much public discussion in London many years since, a simple circumstance led to the inference that certain stabs or cuts through a shirt had not been produced while the shirt was on, but while it was off the body. There were two cuts in the shirt near to each other, precisely similar in size, form, and direction; in fact, the knife or dagger producing them must have gone through a fold of the shirt, so accurate was the correspondence. Then, however, it followed that the shirt could not have been upon the body of the wounded person, as he alleged, because a stab through a shirt when worn over the skin must, in order to reach the body, traverse not only a fold (producing two cuts), but a single layer in contact with the skin, and thus produce *three cuts*, or, in the event of traversing two folds, *five cuts*. In simulating the wounds by cuts on the shirt, the person is supposed to have forgotten this, and have merely stabbed a fold of the shirt while lying on a table, or in some situation convenient for the purpose. This, among other facts, rendered it probable that the slight wounds on the chest were self-inflicted. A case occurred as Nottingham, in 1872, which shows how persons who inflict wounds, and at the same time cut the dress covering the wounded part, may furnish evidence against themselves. A youth charged a man with unlawfully wounding him on the highway. He stated that the man had stabbed him in the arm, cutting through his shirt and coat-sleeve. There was no attempt at robbery, and no motive for such an act. On examining the coat and shirt-sleeve it was found that they had been cut, but there was no corresponding cut in the lining of the coat-sleeve. The prosecutor could give no explanation of this. It was clear that the charge was false, that there had been no cutting or stabbing by another, but that the wound was self-inflicted when the coat was not worn. The youth wished to leave the place where he had been sent for private study, and he had adopted this plan to induce his friends to remove him.

It has been contended that no rules can be laid down for the detection of such cases; each must be decided by the facts which accompany it. The facts which a medical man must endeavour to ascertain are the following:—1. The relative positions of the assailant and the assailed person at the time of the alleged attack. 2. The situation, direction, and depth of the wound or wounds. 3. The situation or direction of marks of blood or wounds on the person or dress of either, or of both the assailant and assailed. 4. The marks of blood, and the quantity effused at the spot where the mortal struggle is alleged to have taken place. The importance of these inquiries cannot be over-estimated. A strong suspicion was raised against the then Duke of Cumberland, in 1810, in reference to the death of *Sellis*, when a skilful examination of the wounds on the deceased would have shown that they might have been self-inflicted.

It is worthy of remark that imputed wounds are generally *cuts* or *stabs*. They are seldom of the contused kind; the impostor cannot, in reference to contusions, so easily calculate upon the amount of mischief which is likely to ensue. Bergeret, however, has related some cases in which females labouring under hysterical attacks have inflicted upon themselves severe contusions, and have charged innocent persons with attempts to murder. ('Ann. d'Hyg.,' 1863, t. 1, p. 463.)

In general the inconsistency of the story is so palpable as to betray the imposture at once; but the public are easily deceived, and much prejudice is often unjustly excited against those who have been falsely accused. Slight excoriations or bruises may be magnified into marks of murderous violence; and if a medical man can be found to admit in an unqualified form that a severe blow may be inflicted and yet leave but slight marks on the skin, the charge will be considered proved against the unfortunate accused.

The case of *M. Armand*, a merchant of Montpellier, who was tried at the assizes at Aix, in March, 1864, for an alleged murderous assault upon his servant Maurice Roux, furnishes a good illustration of the readiness with which the most inconsistent stories are accepted by the public, when they are supported by pseudo-medical evidence. This case was rather one of imputed homicidal strangulation than self-inflicted wounding; nevertheless, a foundation was laid for medical opinions by the presence, as it was alleged, of a slight excoriation of the skin on the nape of the neck. The injury was so slight that it escaped the observation of some medical men who examined the complainant, and there could be no doubt from the facts that it had been produced, either accidentally or designedly, by the complainant on himself. Several medical gentlemen, taking the man's story as true, asserted without any qualification: 1. That a blow on the nape of the neck might produce cerebral concussion and syncope. 2. That a blow to produce such effects need not be violent. 3. That such a blow so inflicted would not always leave upon the skin marks of contusion or ecchymosis. These admissions were taken by the court to support the man's story—that his master had struck a severe blow on the back of his neck, that this blow had produced concussion of the brain, and that he had been rendered insensible for many hours. ('Ann. d'Hyg.,' 1864, t. 1, p. 451.) The evidence for the defence, and chiefly that given by Tardieu, removed the evil effect produced by such loose medical statements as these, and satisfied the jury that the story of the complainant was a pure fabrication. The accused was justly acquitted of the charge. Although it has been elsewhere stated that severe blows are not always attended with external marks of violence (p. 238), it by no means follows that such blows have been struck in all cases in which the skin presents a slight abrasion. This would be converting the exception into the rule, and every superficial injury might be thus distorted into a proof of the infliction of murderous violence.

Pistol-shot wounds are sometimes voluntarily inflicted for the purpose of imputing murder or extorting charity. A man intending to commit suicide by firearms, and failing in the attempt, may, from shame and a desire to conceal his act, attribute the wound to the hand of some assassin. In examining such imputed wounds, they will not be found to involve vital parts, except in cases of attempted suicide; and they will possess all the characters of near wounds produced by gunpowder, wadding, or a bullet. The skin around will be more or less lacerated and bruised; there will be much ecchymosis, and the hand holding the weapon, as well as the dress and the wounded skin, may be blackened or burnt by the exploded gunpowder. A pistol-shot wound from an assassin may be produced from a distance, while an imputed wound which is inflicted by a person on himself must always partake of the characters of a near wound.

CHAPTER 25.

WOUNDS INDICATIVE OF HOMICIDE, SUICIDE, OR ACCIDENT.—EVIDENCE FROM THE SITUATION OF A WOUND.—EVIDENCE FROM ITS NATURE AND EXTENT.—EVIDENCE FROM THE DIRECTION OF A WOUND.—WOUNDS INFLICTED BY THE RIGHT OR LEFT HAND.—SEVERAL WOUNDS.—USE OF SEVERAL WEAPONS.

Wounds indicative of Homicide, Suicide, or Accident.—Supposing that the wound which is found on a dead body is proved to have been caused before death, it may be necessary to inquire whether it was the result of *suicide, homicide,* or *accident.* It might at first sight be considered that the determination of a question of this nature was wholly out of the province of a medical jurist. In some instances it may be so, and the settlement of it is then properly left to the legal authorities; but, in a large number of cases, it is so closely dependent for its elucidation on medical facts and opinions, that juries could never arrive at a satisfactory decision without medical evidence. Let us suppose, then, that a medical jurist is consulted in a doubtful case: what are the points to which he should direct his attention? They are, with regard to the wound, (1) its *situation,* (2) its *nature* and *extent,* and (3) its *direction.*

1. *Evidence from the Situation of a Wound.*—It is a general principle, in which most medical jurists agree, that wounds inflicted by a suicide are usually confined to the fore or lateral parts of the body. The throat and chest are commonly selected when cutting instruments are employed; while the chest, especially in the region of the heart, the mouth, the orbit, and the temples, are the spots generally chosen for the perpetration of suicide by firearms. But it is obvious that any of these parts may be also selected by a murderer, with the especial design of simulating a suicidal attempt; therefore the mere situation of a wound does not suffice to establish the fact of suicide. Some have regarded it as fully established in legal medicine, that, when wounds exist at the back part of the body, it is a positive proof that they have not been self-inflicted. This situation is certainly unusual in cases of suicide; but, as Orfila observes, it is not the situation, so much as the direction of a wound, which here furnishes evidence against the presumption of suicide. A wound, traversing the body from behind to before in a direct line, is not likely to have resulted from a suicidal attempt: at least it must be obvious that it would require more preparation and contrivance on the part of a self-murderer so as to arrange matters that such a wound should be produced than we can believe

him to possess at the moment of attempting his life. Besides, his object is to destroy himself as quickly and as surely as circumstances will permit; he is, therefore, not likely to adopt complicated and uncertain means for carrying this design into execution. Nevertheless, we must not always expect to find suicidal wounds in what an anatomist would pronounce to be the most appropriate situation to produce instant destruction. An incised wound in a concealed or not easily accessible part is presumptive of murder, because this kind of injury could have resulted only from a deliberate use of the weapon. Suicidal wounds are, however, sometimes found in unusual situations. Thus the blood-vessels of the arms or legs may be the seat of injury. *Abdul Aziz*, Sultan of Turkey, was found dead under suspicious circumstances. The arms presented two gashes at the bend of each elbow in front. The direction of both of these wounds was oblique, from above downwards and from within outwards, and their edges were jagged. That on the left arm penetrated to the joint. The superficial veins and the deep-seated tissues were cut through, and the ulnar artery laid open, but not entirely divided. The wound on the right arm was superficial, involving only the skin and the veins. The bleeding from the ulnar artery and veins had led to death. The dress was soaked with blood. A pair of scissors stained with blood was found upon the sofa. Although the situation of these wounds is unusual, there is nothing in them inconsistent with suicide. The body was examined by nineteen physicians, and they agreed in signing a report that the act was suicidal. Unfortunately, they assigned, as one of their reasons, 'that the *direction* and *nature* of the wounds, as well as the instrument which might have effected them (the scissors), lead to the conclusion of suicide;' whereas it is perfectly clear from the description that such wounds as these might have been easily produced by an assassin, and that their situation, nature, and direction were very unusual in cases of suicide. In reference to this subject, it has been truly remarked that there is no wound which a suicide is capable of inflicting upon himself which may not be produced by a murderer; but there are many wounds inflicted by a murderer which, from their situation and other circumstances, a suicide would be incapable of producing on his own person. We cannot always obtain certainty in a question of this kind,—the facts will often allow us to speak only with different degrees of probability. See the case of Elizabeth Gibbons, convicted of the murder of her husband. (See p. 256, *post.*)

The situation of a wound sometimes serves to show whether it is of an *accidental* nature or not—a point often insisted on in the defence. Accidental wounds are generally found on those parts of the body which are *exposed*. Some wounds, however, forbid the supposition of accident even when exposed; as deeply-incised wounds of the throat, the gunshot wounds of the mouth and temples. (For the report of a case in which an accidental wound on the head by an axe closely simulated a homicidal wound, see Casper's 'Wochenschrift,' May 24, 1845.)

2. *Evidence from the Nature and Extent of a Wound.*—Contused wounds are rarely seen in cases of suicide, because in producing them there is not that certainty of speedily destroying life to which a self-murderer commonly looks. There are, of course, exceptions to this remark; as where, for instance, a man precipitates himself from a considerable height, and is wounded by the fall. Circumstantial evidence will, however, rarely fail to clear up a case of this description. Greater difficulty may exist when life is destroyed by a contused wound voluntarily inflicted. When persons labouring under insanity or delirium commit suicide, they often inflict upon themselves wounds of an extraordinary kind, such as would, at first view, lead to a suspicion that they had been produced by the hand of a murderer; and, therefore, the rules which are here laid down to distinguish homicidal from suicidal wounds must be guardedly applied to cases of this kind. In 1850, a case occurred at Guy's Hospital, in which a patient in a fit of delirium tore away the whole of the abdominal muscles from the lower and fore part of the abdomen. Had the body of this person been found dead with such an unusual and serious personal injury, it is not improbable that it would have been pronounced homicidal, and not suicidal. In 1876, a French artisan was found dead, with a severe wound in his throat. He had weighted a large knife with heavy stones, and had placed it between two upright planks, on the principle of the guillotine. He had so placed his neck that when the knife fell by releasing a string it would cause a fatal wound. In the following case, but for the facts being known, an accidental wound in a concealed part of the body might have been pronounced to be homicidal. A girl, æt. 15, while jumping on to the knee of her uncle, received a severe wound under the following circumstances. He was holding a stick between his legs, and the girl did not observe it. In the act of jumping, this passed up the anus. She withdrew the stick, and, though she complained of pain, she amused herself as usual. On the following night acute symptoms set in, and she died in forty-eight hours, of peritonitis. A rent was found in the fore part of the rectum which had penetrated the peritoneal cavity. ('Brit. Med. Jour.,' 1874, ii. p. 403.) The body of a man was found in a lane near Rhyl. It appeared that the deceased had stretched himself on his back on the ground, unbuttoned and turned back the lower part of his vest on the left side, and had then thrust the long thin blade of a pocket-knife into the heart, between the fifth and sixth ribs. The knife was found on his breast, close to the wound. The body was warm when found. He had not been disturbed; there had been no robbery of his person, his hat remained on his head, and his gloves in his left hand. He had arrived at Rhyl that afternoon. Everything indicated great deliberation.

The *extent* of a wound, by which we are to understand the number and importance of the parts injured, must in these cases be always taken into consideration. It has been somewhat hastily laid down as a rule, that an extensive wound of the throat, involving all the vessels and soft parts of the neck to the spine, could not be self-inflicted.

Although, in general, suicidal wounds of this part of the body do not reach far back, or involve the vessels of more than one side, yet we find occasionally that all the soft parts are thus completely divided. These are cases in which, perhaps, with a firm hand, there is a most determined purpose of self-destruction. In a case of suicide, observed by Marc, the weapon had divided all the muscles of the neck, the windpipe, and gullet—had opened the jugular veins and both carotid arteries, and had even grazed the anterior ligaments of the spine. A wound so extensive as this is rarely seen in a case of suicide, but there is no ground for the assertion that such extensive wounds in the throat are incompatible with self-destruction. (See also 'Ann. d'Hyg.,' 1872, t. 1, p. 419.)

Incised wounds in the throat are generally set down as presumptive of suicide, but murderers sometimes wound this part for the more effectual concealment of crime. Circumstances connected with the form and direction of a wound may in such cases lead to detection; for, unless the person attacked be asleep or intoxicated, resistance is offered, evidence of which may be obtained by the presence of great irregularity in the wound or the marks of other wounds on the hands and person of the deceased. The peculiar form of a wound on the throat has sometimes led to a justifiable suspicion of homicide. In one instance a man was found dead with his throat cut in the manner in which butchers are accustomed to kill sheep. This led the medical man to believe that the wound had been inflicted by a butcher. The police, guided by this observation, arrested a butcher, who was subsequently tried and convicted of the murder. In some instances, however, it is extremely difficult to say whether the wound is homicidal or suicidal, the medical facts being equally explicable on either hypothesis. (See case by Marc, 'Ann. d'Hyg.,' 1830, t. 2, p. 408; another by Devergie, ibid. 414; and a third by Ollivier, 'Ann. d'Hyg.,' 1836, t. 1, p. 394.) *Regularity* in a wound of the throat has been considered to be presumptive of suicide. This was the publicly-expressed opinion of Sir Everard Home in the well-known case of *Sellis*. The deceased was found lying on a bed, with his throat extensively cut, and the edges of the incision were regular and even. This condition of the wound, it was inferred, repudiated the idea of homicide; but, as a general principle, it appears to me to be a fallacious criterion. A murderer, by surprising his victim from behind, by having others at hand to assist him, or by directing his attack against one who is asleep or intoxicated, or who from age or infirmity is incapable of offering resistance, may easily produce a regular and clean incision on the throat.

3. *Evidence from the Direction of a Wound.*—The direction of a wound has been considered by some to afford presumptive evidence sufficiently strong to guide a medical jurist in this inquiry. It has been remarked that in most suicidal wounds which affect the throat, the direction of the cut is commonly from left to right, either transversely or passing obliquely from above downwards; in suicidal stabs and punctured wounds the direction is commonly from right to left

and from above downwards. In left-handed persons, the direction would, of course, be precisely the reverse. Suicidal wounds are, however, subject to such variation in extent and direction that it is scarcely possible to generalize with respect to them. Nevertheless, an attention to these points may sometimes be of real assistance to the inquirer, especially when the body has not been removed from its position. It is recommended that the instrument with which the wound has been inflicted should be placed in either hand of the deceased and the arm moved towards the wounded part, so that it may be clearly seen whether the direction of the wound could or could not correspond to it in any position. It might happen that neither arm would reach the wounded part, so as to inflict a wound of the particular direction observed: this may be the case in wounds situated on the back. It is obvious that if a murderer makes an incised wound in the front of the throat from behind, the direction may be the same as that commonly observed in cases of suicide. (See on this point the case of *Reg.* v. *Dalmas*, C. C. C., May, 1844.) Again, if the person attacked is powerless, the wound may be deliberately made, so as to simulate a suicidal act; indeed, murderers seldom attack the throat except with the design of simulating an act of suicide. A homicidal stab may also take the same direction as one which is suicidal, but this wound would be confined to those cases in which the assailant was placed behind or aside. If in front of the person whom he attacks, the direction would probably be from left to right; but in suicide, when the right hand is commonly used, it is the reverse. Oblique wounds, passing from above downwards, are common to homicide and suicide, but those which take an oblique course from below upwards are generally indicative of homicide, for it is extremely rare that a person bent on suicide, unless a lunatic, thus uses a weapon. Homicidal incisions, especially in the throat, are often prolonged below and behind the skin forming the angles of a wound, deeply into the soft parts. Those which are suicidal rarely possess this character; they terminate gradually in a sharp angle, and the skin itself is the furthest point wounded; the weapon is not carried either behind, below, or beneath it. Suicides may graze the ligaments in front of the spinal column, but that they should make deep incisions into the bones, cut off hard bony processes, and divide the intervertebral substance and the vertebral arteries, is a proposition contrary to all experience and probability. The case of the *Earl of Essex*, who was found dead in the Tower in 1683, bore somewhat on these points. The deceased was discovered with his throat cut, and a razor lying near him. This razor was found to be much notched, while the throat was smoothly and evenly cut from one side to the other and to the vertebral column. Some considered this to have been an act of suicide, others of murder. Those medical witnesses who supported the view of suicide were asked to explain how it was that such an even wound could have been produced by a notched razor. They attempted to account for this by asserting that the deceased had probably drawn the razor backwards and forwards across the neck-bone; forgetting that before this could have been done by the deceased, all the great vessels of the neck must have been divided. Exceptions to these characters of homicidal and suicidal wounds may exist; but in a dark and intricate subject of this nature we have only limited rules to guide us. The instrument with which a wound is supposed to have been inflicted should be adapted to the edges of the incision, its sharpness compared with the cleanness and evenness of the cut, and its length with the depth of the incision or stab. It is no uncommon occurrence for a murderer to substitute some instrument, belonging to the deceased or another person, for that which he has actually employed; and this by its size, shape, bluntness, or other peculiarities, may not account for the appearances presented by the wound.

It is not often that any difficulty is experienced in distinguishing a *suicidal* from an *accidental* wound. When a wound has really been suicidally inflicted, there are generally to be found about it clear indications of design; and the whole of the circumstances are seldom reconcilable with the supposition of accident. But if the position of the deceased with respect to surrounding objects has been disturbed; if the weapon has been removed, and the body carried to a distance; then it will not always be easy to distinguish a wound accidentally received from one inflicted by a suicide or a murderer. The evidence of those who find the body can alone clear up the case; and the medical witness may be required to state how far this evidence is consistent with the situation, extent, and direction of the wound found on the deceased. Quite recently, in the case of the Uxbridge murder (*Reg.* v. *Elizabeth Gibbons*, C. C. C., Dec. 1884), the situation, and direction of four gunshot wounds on the deceased man were all-important considerations; and from a careful consideration of these Bowlby was enabled to arrive at a conclusion adverse to suicide. ('Brit. Med. Jour.,' 1885, i. p. 62.) Circumstantial evidence is commonly sufficient to show whether a wound has been accidentally received or not; but as an accidental wound may sometimes resemble one of homicidal or suicidal origin, so it follows that it is not always possible for a medical jurist to decide the question peremptorily from a mere inspection of the wound.

It would not be difficult to produce instances in which murderers have alleged, in defence, that the wounds observed on the bodies of their victims were of accidental origin, and the allegations have been clearly refuted by medical evidence. A witness must be prepared, therefore, in all cases in which death has taken place in secrecy, and the nature of the wound is such as to render its origin doubtful, to be closely examined by counsel for a prisoner charged with felonious homicide, on a question whether the wound might not have been accidental. The law requires that it should be made clear to a jury, before such a charge can be sustained, that the fatal wound could *not* have had an accidental or suicidal origin. The subject of wounds of the neck has been examined in relation to homicide, suicide, and other medico-legal questions, by Güterbock. ('Vierteljahrsschr. f. Gerichtl. Med.,' 1873, 2, p. 1.)

Wounds inflicted by the Right or Left Hand.—Some remarks have been made in reference to the direction of a cut or stab varying according to whether the right or the left hand has been used by a suicide. It is necessary for a medical jurist to be aware that there are many persons who are *ambidextrous, i.e.* who have equal facility in the use of the right and the left hands. This may not be generally known to the friends of the deceased; and such persons are often pronounced, even by those who have associated with them, to have been right-handed. A want of attention to this point is said to have been one of the circumstances which led to a suspicion of murder in the case of *Sellis.* (Wills's 'Circ. Evid.,' p. 97.) The man was found dead on his bed with his throat cut; the razor was discovered on the left side of the bed, whereas it was generally supposed and asserted that he was right-handed. The truth was, he was equally expert in the use of the razor with his left and right hands; and thus the apparently suspicious circumstance of the razor being found on his left side was at once explained away. The importance of making due allowance for the characters presented by wounds in the throat is also illustrated by a case which occurred in London in 1865. A publican and his wife had been frequently in the habit of quarrelling. One night the wife gave an alarm, and the man was found dead on the bed, with his throat severely cut. On examination, the fatal wound had all the characters of a left-handed cut, while the deceased was generally believed to be right-handed; and there was bloody water in a wash-hand basin in the room. The wife, who had marks of bruises upon her, said that she left her husband in the bedroom for a short time, and on her return found him dead. The suspicious facts were explained at the inquest by a daughter of the deceased by a former marriage. She stated that her father had been brought up as a wood-carver, a trade which requires a man to use both hands equally well; that he had frequently threatened to destroy himself; and that the blood in the wash-hand basin was owing to her having washed her hands after she had touched her father's head. This satisfactorily explained the medical circumstances, which appeared at first to point to an act of homicide.

The Presence of Several Wounds.—In suicides, commonly, one wound only is seen, namely, that which has destroyed life, except in cases of cut-throat, and the presence of several wounds on the body, or the marks of several attempts around the principal wound, have been considered to furnish presumptive evidence of murder. But any inferences of this kind must be cautiously drawn, since not only may a murderer destroy his victim by one wound, but a suicide may inflict many, or leave the marks of several attempts before he succeeds in his purpose. Ogston, sen., has pointed out ('Lect. on Med. Jurispr.,' p. 424) that in suicidal cut-throat the principal wound is often associated with small tentative incisions, near and parallel to this; but that in homicidal incised wounds of the throat the tentative cuts, if present, do not preserve the same parallelism—obviously because the victim does not remain passive under the attack of his assailant; and thus the relative positions of the assailant and the assailed are continually changed. Ogston, jun., describes a case in which a man was supposed to have committed suicide by cutting his throat and chest, finishing by drowning himself. The superficial cuts in this case might easily have given rise to a suspicion of murder, had not moral circumstances led the examiner to conclude that the case was one of suicide. ('Edin. Med. and Surg. Jour.,' 1885, i. p. 689.)

The Use of Several Weapons.—In general, suicides, when foiled in a first attempt, continue to use the same weapon; but sometimes, after having made a severe wound in the throat, they will shoot themselves, or adopt some other method of self-destruction. These cases can only appear complicated to those who are unacquainted with the facts relative to self-murder. Neither the presence of several wounds by the same kind of weapon, nor of different wounds by different weapons, can be considered of itself to furnish any proof of the act having been homicidal. In one instance, a lunatic, in committing suicide, inflicted *thirty* wounds upon his head. In a case of murder, when many wounds are found on a dead body, it may happen that the situation or direction of some will be incompatible with the idea of a suicidal origin. Thus a stab or cut may be close to a contusion or contused wound, and although a fall or other accident might account for the latter, the former would indicate violence separately inflicted.

Two or More Mortal Wounds.—When we find several wounds on the body of a suicide, it generally happens that one only bears about it a *mortal* character, namely, that which has caused death. On this account it has been asserted by some medical jurists that, when two mortal wounds are found upon the body, and particularly if one of them is of a stunning or stupefying tendency (*i.e.* affecting the head), they must be considered incompatible with suicide. An inference of this kind can be applied to those cases only in which the two wounds, existing on different parts of the body, were likely to prove immediately fatal. It must, however, be borne in mind that all suicides do not *immediately* perish from wounds which are commonly termed mortal; on the contrary, they have often the power to perform acts of volition and locomotion, which might by some be deemed wholly incompatible with their condition. It is difficult to say whether one wound is likely to destroy life so rapidly as to render it impossible for the person to have inflicted another upon himself; but when there are several distinct incisions on the throat, each involving important blood-vessels, there is good reason to infer that they have resulted from an act of murder.

Wounds produced simultaneously or at different times.—When several wounds are found on a dead body, the question is frequently asked, *Which was first received?* If one is what is commonly termed mortal, and the others not, it is probable that the latter were first inflicted. This remark applies both to cases of homicide and suicide; but it is apparent that when, in a murderous assault, a person has been attacked by several assailants at once, the wounds may have been simultaneously produced. This is, however, a question to which it is not easy to give a specific answer. Each case must be decided from the special circumstances attending it; and in most instances, unless some direct evidence is forthcoming, a medical opinion can be little more than conjectural. It is a question almost always put in a court of law; and a witness should at least prepare himself to meet it by a proper examination of the medical circumstances of the case.

CHAPTER 26.

EVIDENCE FROM CIRCUMSTANCES.—THE POSITION OF THE BODY.—OF THE WEAPON.—EVIDENCE FROM BLOOD, HAIR, AND OTHER SUBSTANCES ON WEAPONS.—MARKS OF BLOOD ON CLOTHING AND FURNITURE, ON THE DECEASED, AND ON THE ASSAILANT.

Evidence from Circumstances.—In pursuing the examination of the question respecting the homicidal or suicidal origin of wounds, the attention of the reader may be called to the force of evidence which is sometimes derived from the circumstances under which the body of a person, dead from wounds, is discovered. It may be said that this is a subject wholly foreign to the duties of a medical jurist, but we cannot agree to this statement. There are few in the profession who, when summoned to aid justice by their science in the detection of crime, do not seek for circumstances by which to support the medical evidence required of them. A practitioner would certainly be wrong to base his professional opinion on these circumstances, but it is scarcely possible for him to avoid drawing an inference from them as they fall under his observation. Care must be taken that this inference is not overstrained. The medical evidence may be of itself weak, and insufficient to support a charge against the accused; in such a case, if any suspicious circumstances have come to his knowledge, the witness may be often unconsciously induced to attach greater importance to the medical facts than he is justified in doing. In short, he may, through a feeling of prejudice, which it is not always easy to avoid, give an undue force to the medical evidence. But if a proper degree of caution is used in drawing inferences, and the circumstances are not allowed to create a prejudice in his mind against the accused, a medical man is bound to observe and record them; for, being commonly the first person called to the deceased, many facts capable of throwing an important light on the cause of death would remain unnoticed or unknown but for his attention to them. The position of a dead body, the suddenness of death, the discovery of a deadly poison, the distance at which a knife or pistol is found, the position of the instrument—whether situated to the right or left of the deceased—the marks of blood or wounds about the person, or of blood on the clothes or furniture of the apartment, are facts which must assist materially in developing the real nature of a case, and in giving force to a medical opinion. Many of these circumstances can fall under the notice of him only who is first called to the deceased; and, indeed, if observed by another, no advantage could be taken of them, except from the interpretation of a medical man.

At the same time, a person may have died suddenly, and a weapon or poison be found near the body, and yet the death may have taken place from natural causes. Due allowance must be made for coincidences of this kind. The purchase and possession of a deadly poison shortly before a sudden death may create suspicion, but an analysis may show that there is no poison in the body, and further that the post-mortem appearances are consistent with natural disease, and, unless treated as exceptional in character, they are not consistent with death from poison. A woman was found dead under very suspicious circumstances. Within half an hour of her death she had sent a boy to a shop to purchase a packet of Battle's vermin-killer (strychnine). He gave it to her and left the house. When he returned at the time mentioned, he found her leaning on the table, speechless and motionless. She was then dead. There was no rigidity and no evidence of convulsions. Some fluid was found in the stomach, but in this there was no strychnine, and none of the blue colouring matter which had been sold with the powder. No trace of the powder could be found on the premises, and no cup, glass, or vessel in which the poison might have been mixed, could be seen. ('Med. Times and Gaz.,' 1865, i. p. 34.) The absence of any characteristic symptoms, and the non-detection of the poison and its colouring ingredient under the circumstances, negatived the suspicion of poisoning. The purchase, possession, and the non-discovery of the purchased packet after the death of the woman, were circumstances which created suspicion, but nothing more. The state of the lungs and heart was sufficient to account for sudden death.

Among the questions which present themselves on these occasions are the following:—Is the position of a wounded body *that* which a suicide could have assumed? Is the distance of a weapon from the body such as to render it improbable that it could have been placed there by the deceased? In answering either of these questions, it is necessary to take into consideration the extent of the wound, and the time at which it probably proved fatal. Again, it may be inquired, Has the deceased bled in more places than one? Are the streams of blood all connected? Are there any marks of blood on his person or clothes which he could not well have produced himself? Are there any projecting nails, or other articles, which might account for wounds on the body as the result of accident? These are questions, the answers to which may materially affect the case: hence, a practitioner, in noticing and recording the circumstances involved in them, ought to exercise due caution.

The rules for investigating a case of alleged death from violence have been elsewhere described (p. 6, *ante*). Among the additional circumstances to which a medical witness should specially direct his attention on these occasions are the following:—

1. *The Position of the Body.*—The body may be found in a position which the deceased could not have assumed on the supposition of the wound or injury having been accidental or suicidal. The position of a dead wounded body is often only compatible with homicidal interference, either at the time of death or immediately afterwards. In order to determine the probable time of death, we should always notice whether there is any warmth about the body—whether it is rigid, or in a state of decomposition, and to what degree this may have advanced.

2. *The Position of the Weapon.*—If a person has died from an accidental or self-inflicted wound, likely to cause death either immediately or within a few minutes, the weapon is commonly found either near to the body or within a short distance of it. If found near, it is proper to notice on which side of the body it is lying; if at a short distance, we must consider whether it might have fallen to the spot, or have been thrown or placed there by the deceased. If there have been any interference with the body, evidence from the relative position of it and the weapon will be inadmissible. In a case which was referred to the author some years since, a woman had evidently died from a severe wound in the throat, which was homicidally inflicted; the weapon, a razor, was found under the left shoulder, a most unusual situation, but which, it appears, it had taken owing to the body having been carelessly turned over before it was seen by the surgeon who was first called.

It is compatible with suicide that a weapon may be found at some distance, or in a concealed situation; but it is much more frequently either grasped in the hand, or lying by the side of the deceased. In one instance it is stated the deceased was discovered in bed with his throat cut, the razor lying *closed* or shut by his side. In another case, the bloody razor, closed, was found in the deceased's pocket. There is, however, one circumstance in relation to the weapon which is strongly confirmatory of *suicide*. If the instrument is firmly grasped in the hand of the deceased, no better circumstantial evidence of suicide can be offered. It is so common to find knives, razors, and pistols grasped in the hands of suicides, that it is quite unnecessary to produce cases illustrative of this statement. The grasping of a weapon appears to be owing to muscular spasm persisting after death, and manifesting itself under the form of what has been called cadaveric spasm—a condition quite distinct from rigidity, although often running into it. It does not seem possible that any murderer could imitate this state, since the relaxed hand of a dead person cannot be made to grasp or retain a weapon, like the hand which has firmly held it by powerful muscular contraction at the last moment of life.

Experiments performed by Hofmann ('Méd. Leg.,' trad. par Brouardel, p. 601) completely confirm this statement. By a variety of artificial contrivances—the use of ligatures, &c.—attempts were made to cause the hand of a recently dead body to hold a weapon firmly as if by a voluntary contraction of the muscles during life; but these attempts utterly failed to produce any such results. Although the fingers were kept completely closed on the object, it was simply held, and not grasped, falling from the hand immediately on the release of the pressure.

In reference to the weapon being found at a distance from the body, all the circumstances of the case should be taken into consideration before any opinion is expressed. If the weapon cannot be discovered, or it is found concealed in a distant place, this is strongly presumptive of homicide, provided the wound is of such a nature as to prove speedily fatal. If found near the body, it will be well to notice whether the weapon is sharp or blunt, straight or bent, also whether the edge is or is not notched. These circumstances may throw a light on the question of suicide or murder.

3. *Blood on Weapons.*—The weapon with which a wound has been inflicted is not necessarily covered with blood. The popular view is, that if much blood is found about a dead body, the weapon ought always to be more or less bloody. In reference to heavy blunt instruments applied with force to the head, severe contusions and fractures may be produced without immediate effusion of blood. Unless the bludgeon is used in a subsequent struggle, or handled by a bloody hand, no blood whatever may be found on the end which produced the injuries. In reference to stabs, the knife is frequently without any stains of blood upon it, or there is only a slight film, which, on drying, gives to the surface a yellowish-brown colour. The explanation of these facts appears to be that in a rapid blow or plunge the vessels are compressed, so that bleeding takes place only after the sudden withdrawal, when the pressure is removed. Even if blood should be effused, the weapon, in being withdrawn, is sometimes cleanly wiped against the edges of the wound, owing to the elasticity of the skin. Thus the first stab through the dress may not present any appearance of blood on the outside, but in a second stab, with the same weapon, the outside of the dress should present a bloody mark, unless the weapon had previously been wiped (p. 247). The blood may have been removed by washing, from the blade of a knife or dagger; hence the handle and inner portions, the dirt accumulated between the handle and blade, the notch for opening the blade, and the indentations of any letters stamped upon it, should be closely examined with the microscope.

The blood on a weapon may be wet or dry, in a partly coagulated state, or diffused as a mere yellowish-red film. If coagulated, this would render it probable that the blood had issued from the body of a living person or animal, or from a body recently dead. But the blood of a *dead* animal dried in small spots on the blade of a knife may sometimes present a similar appearance, and thus lead to a mistake in evidence.

4. *Hair and other Substances on Weapons.*—In some instances no blood may exist on a weapon, but a few hairs or fibres may be found adhering to it if the weapon is of a bruising or cutting kind. The main questions may be, in such a case, whether the hair is that of a human being or of an animal, and whether the fibres correspond in their nature, form, and colour to articles of dress on the deceased or the

accused. Before any coagulated blood is removed from a weapon, it should be examined carefully with the microscope. Hairs or fibres of linen, woollen, silk, or cotton may be found imbedded in the solidified blood, either on the edge or on the blade; and evidence of this kind may occasionally be of great importance. In a case of murder by manual strangulation, so much violence had been employed by pressure with the fingers, that not only was a quantity of blood effused, but portions of cuticle with the fine downy hairs of the neck of deceased had been removed. The blood with the abraded cuticle and some hairs were found upon a towel which was traced to the assailant. ('Vierteljahrsschr. f. Gerichtl. Med.,' 1873, 2, p. 112.) On a trial for murder in Ireland, in 1877, it was proved that there were hairs firmly clenched in the hands of deceased; and when these were compared with a like number of the prisoner's hair, they were found to correspond.

Foreign substances are sometimes found in contused and lacerated wounds, which may throw a light on the mode in which they were inflicted. In gunshot-wounds it is not unusual to find portions of paper or other substances, used as wadding for the gun or pistol. The preservation of articles of this description, or of portions of the projectiles found under these circumstances, has proved a means of fixing the crime upon the guilty person. When a gun or pistol is discharged near to the body, a portion of the wadding is generally carried into the large irregular wound produced. In a case of stabbing, a portion of the weapon may be found in the wound.

5. *Marks of Blood on Clothing or Furniture.*—It is proper to notice all marks of blood on the clothes of the deceased or in the apartment, and to observe where the greatest quantity of blood has been effused; this is generally found on the spot where the deceased has died. The deceased may have bled in more places than one; if so, it should be noticed whether there is any communication in blood between these different places. Blood on distant clothes or furniture may show whether the deceased has moved about, and whether he has struggled much after receiving the fatal wound. Acts of locomotion by a wounded person who has died from loss of blood, or by a criminal whose hands and feet are bloody, are generally indicated by tracks or marks of blood. (*Reg.* v. *Garry*, Lincoln Spring Ass., 1883.) The observation of these marks, if made at the time that a dead body is found, is of great importance. They may be so situated as to show that the body of the deceased has been moved or been interfered with after death, and thus throw a light upon the question whether the act has been one of homicide or of suicide. In reference to clothing, it is advisable, if it be possible, to have some clear proof that the clothes sent for examination were actually worn by the accused or belonged to the deceased. Serious mistakes are sometimes made, and medical opinions should therefore be expressed with caution. It should be noticed on these occasions whether the blood is deposited in large patches on clothing, or whether it is sprinkled, and also whether it is in large or small quantity. The sprinkling may have proceeded from a wounded artery, or from a splashing of blood as a result of continued

violence. It should likewise be observed whether, if the wound is in the throat or chest, blood has flowed down in front of the clothes or person, or whether it has flowed so as to collect in the armpits or on each side of the neck; for these appearances will sometimes show that the wound was inflicted when the person was standing, sitting, or lying down. If the throat is cut while the person is lying down, it is obvious that the blood will be found chiefly on one or other side of the neck, and not extending down the front of the body. Few suicides cut the throat while in a recumbent posture, and the course which the blood has taken may, therefore, be sometimes rendered subservient to the distinction of a homicidal from a suicidal wound. The position in which the body was when a wound was inflicted is a frequent question at inquests and criminal trials.

When spots of blood are found upon articles of dress or furniture, their *form* and *direction* may occasionally serve to furnish an indication of the position of the wounded person with respect to them. Thus, if the form of a spot is oval and elongated, the presumption is that the person was placed obliquely with respect to the stained furniture during the hæmorrhage. ('Ann. d'Hyg.,' 1840, p. 397.) The force with which the blood has been thrown out will be in some measure indicated by the degree of obliquity and length of the spot. This is in general wide and rounded at the upper part, but narrow and pointed below.

6. *Marks of Blood or Violence on the Dead Body.*—In examining a dead body, attention should be paid to the state of the *mouth* and *throat.* Assailants who make their attack during sleep sometimes endeavour to close the mouth, or to compress the throat, so as to prevent an alarm being given. In one instance there were the marks of finger-nails around the mouth; in another, ecchymosed impressions, as if produced by a hand, were found upon the throat of the deceased. The *hands* of a dead person should always be examined; many recent cuts, excoriations, or incisions found upon them, especially if on the back of the fingers or thumbs, will indicate that there has been a mortal struggle with the assailant. In the inspection, the examination of the *stomach* should not be omitted. The presence or absence of food, mucus, or blood, may furnish evidence of considerable importance in the elucidation of the case. All marks or stains of blood or dirt on a dead body require special observation. The impression of a hand, or of some of the fingers, may be found on the skin in a situation where it would have been improbable or impossible for the deceased to have produced it, even supposing that one or both of his hands were covered with blood. In one case of murder there was found the bloody impression of a left hand upon the back of the *left hand* of the deceased, in such a position that it was quite impossible the deceased himself could have made the mark. In all cases it should be noticed whether the *inside* or *outside* of the hand, or whether one or both hands, are stained with blood, and the size and position of the stains should be described. Marks of blood on the dress of a wounded person or a dead body may often furnish important circumstantial evidence. If there are several

stabs or cuts on the body involving the dress, it should be observed whether the edges of one or more of them are stained with blood, as if from the wiping of a weapon, and whether the stain is on the outside or inside of the article of dress. In simulated personal injuries, the stain of blood may be, through inadvertence, applied to the outside of the dress—a fact which might, in some instances, lead to the detection of the imposture. (See case 'Ann. d'Hyg.,' 1847, t. 2, p. 219.)

7. *Marks of Blood on the Assailant.*—It is a very common idea that no person can commit a murder in which blood is effused, without having his person and clothes more or less covered with blood. Nothing can be more erroneous. On several occasions we have been required to examine articles of clothing which have been worn by persons subsequently convicted of murder by wounding, and either no blood has been found on any part of the dress, or only small spots wholly out of proportion to the quantity of blood which must have flowed from the deceased. (*Reg.* v. *Harrington*, Chelmsford Ass., 1852; *Reg.* v. *Flack*, Ipswich Ass., 1853; *Reg.* v. *Cass*, Carlisle Ass., 1860; *Reg.* v. *Rowlands*, Beaumaris Ass., 1861; *Reg.* v. *Edmonds*, Swansea Ass., 1862; *Reg.* v. *Shrimpton*, Worcester Ass., May, 1885; *Reg.* v. *Goodale*, Norwich Ass., Nov. 1885.) In the case of *Gardner* (C. C. C., 1862), in which there had been a large effusion of blood from a severe wound in the throat, no blood-stains were found on the clothing of the man who was convicted of the murder. (See also *Reg.* v. *Garry*, Lincoln Spring Ass., 1883.) Policemen are frequently misled in searching for criminals by looking for blood on clothing, as a necessary accompaniment of an act of murder. This also leads them to magnify stains of red paint, iron rust, and fruit-stains on the dress of an accused person into marks of blood. (*Reg.* v. *Moore*, Maidstone Sum. Ass., 1872.)

It is obvious that the throat of a person while standing, sitting, or kneeling, may be cut by a murderer from behind, and thus in appearance simulate suicide. Under these circumstances, the clothes of the assassin would escape being stained with blood. The flowing or spurting of blood upon the clothes of the assailant will depend upon his position in relation to the deceased at the time of inflicting the wound, and this must always be a matter of pure speculation. In entire violation of this simple principle, the fact of a prisoner's clothes not being marked with blood has been on more than one occasion urged as a proof of his innocence. (*Reg.* v. *Dalmas*, C. C. C., June, 1844.) In this case the counsel for the prisoner wished to impress the jury that no person could cut the throat of another without having his clothes covered with blood; and as there was not proved to be any blood on his clothes, the prisoner could not have been guilty of the crime. The facts were simply that the throat of the woman was cut while she was walking across Battersea Bridge, the prisoner having inflicted the wound from behind.

Another circumstance to be noticed is that the accused may have had time to change his clothes in spite of the supposed vigilance of the police. This has occurred in several trials for murder. (*Reg.* v. *Heath*, Bucks Lent Ass., 1854; *Reg.* v. *Cass*, Cumberland Ass., 1860.) In one case the trousers taken from the prisoner soon after the murder presented no marks of blood; but the trousers actually worn by him were found with blood upon them pending the trial. In other instances, the prisoner may have had time to remove any stains by washing. (*Reg.* v. *Goodale*, Norwich Ass., Nov. 1885.) Owing to this erroneous assumption that where much blood has been lost by the deceased, the assassin's clothes could not have escaped being 'deluged' with blood, juries have been led to return verdicts of acquittal in cases in which, although no blood-stains were found, the circumstances proved were consistent only with the theory of murder.

On the trial of *Sub-Inspector Montgomery* for the murder of Mr. Glasse (Omagh Ass., July, 1873), the absence of blood-stains on the clothing of the prisoner was alleged to be a strong proof of his innocence of the crime. In this case the wounds on the head of the deceased were of a contused kind, produced by a bill-hook. There was blood on the floor around the body, but much of this had, no doubt, flowed from the wounds after death. The wounds were not likely to have been attended with a great spurting of blood or any copious effusion at the time of their infliction, yet it was assumed that such murder could not have been perpetrated without the clothes of the assassin being 'covered' with blood. As the evidence against the accused was entirely circumstantial, much stress was laid upon the state of the clothes as a proof of his innocence. The prisoner had been previously tried twice for the crime, and the juries were not able to agree, chiefly owing to the fact that there was no blood upon his clothes. On the third trial he was convicted, and the conviction was immediately afterwards justified by an admission of his guilt. He admitted that he had removed the blood-stains from his clothes with cold water soon after the perpetration of the crime. A case like this is surely sufficient to show the danger of trusting to such a fallacious criterion as a proof of innocence.

The counsel who defended *Courvoisier* for the murder of Lord William Russell (*Reg.* v. *Courvoisier*, C. C. C., 1840) contended, in the strongest terms, that the accused could not have perpetrated the crime because there were no marks of blood on any of his clothes, and no bloody weapon was found in his possession or in the house. As all the vessels of the throat of the deceased had been cut to the vertebral column while he was lying asleep, it was alleged to be impossible that the assassin could have escaped from the spurting of blood from the large vessels. After his conviction, the prisoner admitted that when he committed the murder at night he wore no clothes, but was in a state of nudity, and that all he did was to wash his hands. The weapon which he employed was the carving-knife of the house, which he washed and returned to the tray with the other knives. A similar defence was raised in *Reg.* v. *Thompson* (Durham Wint. Ass., 1863), in which the prisoner was charged with the murder of his wife, by cutting her throat with a razor. According to the medical evidence, the wound in the woman's throat was five inches in length, and in a direction from left to right, extending from the angle of the left jaw to an inch behind the right ear, dividing all the blood-vessels and nerves of the throat. The medical witness properly stated that such a wound could not have been self-inflicted. It proved rapidly fatal. No razor or other weapon that could have produced the wound was found near the body. The prisoner stated that the wounds had been produced on herself by deceased during a struggle. No blood was found on the prisoner's clothing, and on this fact the counsel for the defence mainly relied to show that this was not an act of murder, but of self-destruction. The man was convicted, and the case here quoted proved that the defence was based on a pure fallacy. ('Times' of Dec. 17, 1873.)

The presence of spots of blood on articles of clothing, knives, &c., taken from the persons of those who are accused of murder, may be quite consistent with innocence. Small spots or stains have often an undue importance attached to them. We have known minute spots of blood on the shirt of a man tried for murder by wounding regarded as furnishing proof of criminality, until it was explained that they were probably derived from flea-bites, and that some were on one side and some on the other side, showing that the shirt had been worn on the two sides. The coarse clothing worn by labourers may acquire blood-spots from a variety of accidental circumstances, which the accused may not always be able to explain. When he knows the stains are there, and manifests great anxiety to give some explanation of their presence, as by falsely stating that he had assisted in killing a pig, a rabbit, or that he was carrying game about him, there may be strong ground for suspicion; but a medical practitioner should always make due allowance for the accidental presence of blood on the clothes of working men.

In a case of suicide, in 1872, by cutting the throat, the son, who first discovered his father lying dead, imagined that he had broken a blood-vessel. The son lifted up the body, and then went for assistance. In this way his hands and clothes became bloody. At the inquest he was closely questioned on this point. There could not be the least doubt that the act was one of suicide, and that the clothes of the son had become accidentally covered with blood in the manner in which he had stated.

CHAPTER 27.

EXAMINATION OF BLOOD-STAINS.—CHEMICAL ANALYSIS. — SPECTROSCOPICAL EXAMINATION.—BLOOD-CRYSTALS.—MICROSCOPICAL EVIDENCE.—BLOOD OF MAN AND ANIMALS.—STAINS OF BLOOD ON LINEN AND OTHER STUFFS.—AGE OR DATE OF THE STAINS.—OTHER STAINS RESEMBLING BLOOD.—BLOOD ON WEAPONS.—ARTERIAL AND VENOUS BLOOD.—VARIETIES OF BLOOD.

Examination of Blood-stains.—It may appear at first sight an easy matter to say whether certain suspected spots or stains on articles of clothing, furniture, or weapons are or are not owing to blood; but in practice great difficulty is often experienced in answering the question. If the stains are large and recent, most persons may be able to form an opinion; but the physical characters of blood are soon changed, even when the stuff is white and otherwise favourable for an examination. If the stains, whether recent or of old standing, are upon dark-dyed woollen stuffs, as blue, black, or brown cloth, or if they appear in the form of small or detached spots, or in thin films on dark clothing or rusty weapons, no one but a competent medical man should be allowed to give an opinion.

Chemical Analysis.—There is no direct chemical process by which blood can be identified, but we presumptively establish its nature by determining the presence and properties of the red colouring matter, or *hæmoglobin.* The chemical properties of the red colouring matter of blood are as follows:—1. It readily dissolves in cold water, forming, if recent, a bright-red solution. 2. The red colour of this solution is not changed to a crimson or a green tint by a few drops of a weak solution of *ammonia.* If the ammonia be concentrated, or added in large quantity, the red liquid will acquire a brownish tint. 3. The red liquid when *boiled* is coagulated—the colour is entirely destroyed, and a muddy-brown flocculent precipitate is formed, the quantity of which will depend on the quantities of colouring matter and of albumen present. The red colouring matter of blood is always more or less mixed with albumen, and it is this substance which gives to a dried blood-stain on linen or cloth a well-marked stiffness, and a glossy surface. Stains from cochineal and the red colours of wine, flowers, and fruit, are dull, and do not cause any stiffening of the fibre of the stained stuff, nor any appearance under the microscope at all resembling a dried coagulum of blood. 4. A solution of the red colouring matter of blood in water produces, with freshly made tincture of *guaiacum,* a reddish-white precipitate of the resin. On adding to this an ethereal solution of *peroxide of hydrogen,* a beautiful blue colour is more or less rapidly brought out. If a sufficient quantity of alcohol or ether be added, the precipitate will be dissolved, and a deep sapphire-blue solution will result. Cochineal and other red colouring matters, when thus treated, give a reddish colour to the resin of the tincture of guaiacum, and undergo no change on the addition of peroxide of hydrogen. They are thus well marked and distinguished from the red colour of blood. Whether the blood is new or old, whether concentrated or much diluted, this test produces the blue coloration. It produces the change better in a diluted than in a concentrated state. A drop of blood diffused through six ounces of water may be thus detected in one or two drachms of the mixture. It is to be noted that the blue colour is produced by blood-pigment only with the mixture of guaiacum *and* peroxide of hydrogen; the production of a blue colour with guaiacum alone is valueless as a test for blood. In all cases it must first be ascertained that tincture of guaiacum alone is not coloured, and then that it becomes coloured on the subsequent addition of peroxide of hydrogen. Tincture of guaiacum is coloured blue by milk, pus, saliva, and by many mineral compounds. Such are the chemical properties of blood, whether taken from the human body or from that of any warm red-blooded animal (Mammalia).

Of the various red colouring matters extracted from vegetable and animal substances, there are none which to the experienced eye present the peculiar crimson-red tint of blood, especially when the substance is examined in a good light with a low power of the microscope. When solutions of these red colouring matters are treated with ammonia, some, such as cochineal, logwood, and the colours of roots and woods, acquire a deep crimson tint; while others, such as the colouring matter of the rose, and the red colours of flowers and fruits, are changed to a blue or green. The red colours are not destroyed by a boiling temperature, and, even when mixed with albumen, this substance is simply coagulated, while the red colouring matter remains unchanged. In the case of blood, the effect of heat is to destroy the colour entirely. When these vegetable colours are found upon linen and similar stuffs, they present under the microscope the appearance of a uniform stain or dye, unlike blood in colour. There is no glossy coagulum to be seen, and the stained stuff is not stiffened as it is by the serum of dried blood.

Spectral Analysis.—Spectral analysis applied to blood has been made the subject of evidence on various trials for murder. The great advantage of this optical method is that it admits of the examination of blood without in any way interfering with the subsequent application of the chemical tests already described. We simply analyse the light as it traverses a clear solution of the red colouring matter, and, with a proper spectral eye-piece attached to a microscope, we notice whether the coloured spectrum has undergone any change. If the red liquid owes its colour to recent or oxidized blood, two dark absorption-bands will be seen breaking the continuity of the coloured spectrum. These are situated respectively near the junction of the yellow with the green rays, and in the middle of the green rays. If the blood is quite recent and of a bright-red colour (oxyhæmoglobin), the two absorption-bands are distinct and well defined. A good light, either artificial or daylight, is required; the coloured liquid should be clear and of sufficient intensity, and the spectrum apparatus properly adjusted. The blood sufficiently diluted should be placed in a glass tube for the purpose of examination. The spectral eye-piece allows of two of these tubes being examined at once, and it is desirable to have a specimen of blood mounted, for comparing the actual spectrum of blood with that of the suspected liquid. The results are the same with the red blood of all animals.

In the course of an hour in warm weather, and after a day or two in cold weather, the blood in the tube undergoes a remarkable change. It loses its scarlet, and acquires a purple, colour (reduced hæmoglobin). In passing to this state it has become deoxidized, and the colouring matter is now called deoxidized hæmoglobin. A small quantity of sulphide of ammonium—or an ammoniacal solution of ferrous tartrate, made by dissolving ferrous sulphate in water, adding a sufficiency of potassium tartrate, and then making alkaline with ammonia (Stokes's solution)—added to red blood, will produce the same effect more rapidly. In this state the two bands appear blended, and one broad dark absorption-band is seen nearly in the same situation. That the blood is really deoxidized is proved by the fact that, on adding to that which has spontaneously changed from red to purple a few drops of peroxide of hydrogen, the blood is re-oxidized, and again acquires its red colour, with the manifestation of the two absorption-bands. The same result takes place if the purple blood is put into a wider tube and well shaken with air. The presence of two bands, with this power of conversion and reconversion by deoxidizing and oxidizing agents, is characteristic of red blood. Blood which had been kept one year sealed up gave one broad black band, covering partly the orange, the whole of the yellow, and a portion of the green rays. There was also a dark band crossing the red rays of the spectrum.

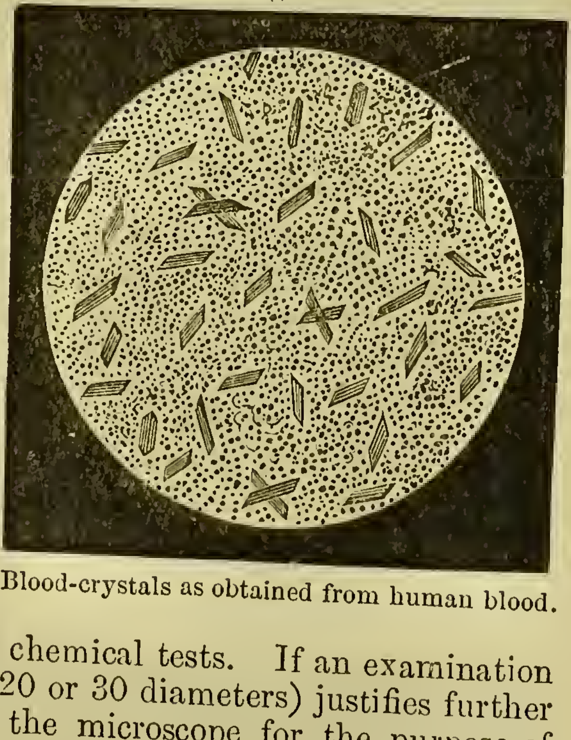
When the blood by long exposure to the air has undergone chemical changes, it ceases to give any *well-defined* absorption-bands. If a solution containing hæmoglobin is acidified with a vegetable acid, the pigment is destroyed, and *hæmatin*, a brown-red pigment, is proved. The same change is effected by prolonged exposure to air. If the acid solution of hæmatin be made alkaline with ammonia, and Stokes's solution (p. 269) be added, two fine dark bands of hæmochromogen (reduced hæmatin) make their appearance. These are more towards the blue end of the spectrum than the two bands of oxyhæmoglobin. A recent blood-stain, however minute, may be made to yield successively the bands of oxyhæmoglobin, of reduced hæmoglobin, and of hæmochromogen.

There can be no doubt that, in the hands of a competent person, and one skilled in micro-spectral observations, this optical method will enable him to discover the minutest trace of blood, provided any *red colouring matter* remains. Thus Sorby states that a spot of blood only one-tenth of an inch in diameter, or a quantity of the red colouring matter amounting to no more than the 1000th part of a grain, was sufficient to give conclusive evidence of its presence by spectral analysis. J. G. Richardson states that by a still more delicate process he has been able to detect the 3000th part of a grain of blood on an axe-handle supposed to have been used in a case of murder. Sorby detected blood in the form of deoxidized hæmatin on the rusty blade of a knife with which a murder was committed in 1862, after the lapse of ten years. Blood-stains which have been washed in water, and blood which has been even boiled or heated to 212° F., may be thus detected. In the latter case ammonia, with the aid of a gentle heat, should be employed to dissolve the matters rendered insoluble by boiling. Spectral analysis does not enable us to make any distinction beyond that of recent and old blood, and this distinction cannot be so drawn as to enable us to fix a specific or even an approximate date. Certain accidental conditions may rapidly produce on blood the same effect as exposure to air for a long period of time. It indicates no distinction in the blood of the sexes, of the fœtus and adult, or in the blood of man and animals. As a corroborative process it furnishes most valuable and trustworthy evidence, and there is no case in which blood admits of a chemical examination, in which spectral analysis does not admit of a safe application before the chemical tests are employed.

In a case of alleged murder, which was the subject of investigation in 1866, some faint reddish-coloured stains on grey woollen cloth, visible only in a strong light, were suspected to have been caused by blood. Other stains on an overcoat worn by the accused person were also attributed to blood. Sorby examined some of the stains by the optical process, and he obtained a distinct spectrum characteristic of blood. The author examined microscopically and chemically other stained portions of the grey woollen cloth, and came to the same conclusion as Sorby, namely, that the faint reddish-coloured stains had been caused by blood. The processes, although widely different, agreed in the results, and it may be mentioned that, from the fact of the blood-stains having been wetted and sponged, a more difficult case for investigation could hardly have presented itself. The methods of examination also agreed in the result that some suspected stains or marks on the overcoat were not caused by blood. The *date* of a blood-stain cannot, however, be determined with any certainty by this process, unless the conditions under which it has been kept are known; and it is not possible to distinguish by it animal from human blood. (See Sorby, 'Quart. Jour. of Sci.,' April, 1865, p. 205; 'Pop. Sci. Rev.,' Jan. 1866, p. 66.)

Hæmin-Crystals.—Another process for the detection of blood consists in the production of microscopic crystals of *hæmin* (hæmatin hydrochlorate). These crystals may be produced by evaporating to dryness a fragment of blood-clot with an excess of glacial acetic acid and a trace of sodium chloride. More acetic acid is then added, and the evaporation repeated, but more slowly. The residue is examined under the microscope, with a power of 300 to 500 diameters. Crystals like those seen in Fig. 41 are observed.

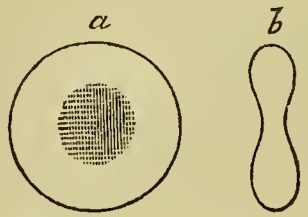
Fig. 41.



Blood-crystals as obtained from human blood.

Microscopical Evidence. Blood-Corpuscles.—Hitherto the microscope has been referred to as an aid to the examiner in drawing a distinction between the appearances presented by blood-stains in the dry state, and those caused by other substances. Its use, however, extends much beyond this. The spots or stains may be so small as not to admit of removal for the purpose of applying chemical tests. If an examination of the dry stain with a low power (20 or 30 diameters) justifies further proceedings, we may then employ the microscope for the purpose of detecting those peculiar bodies on which the colour of red blood is known to depend. The red colouring matter of blood consists of minute coloured corpuscles, floating in a clear liquid (serum). The engraving (Fig. 42) shows the form which the corpuscle presents in the class Mammalia. *a* represents the circular form, when seen in front, the shaded portion being a depression which, under a certain disposition of the light, assumes the appearance of a solid and opaque nucleus; *b* represents the corpuscle seen edgewise, in which case it presents somewhat the outline of a biconcave lens. It owes this form to the central depression on each face. Other red colouring matters, such as madder, cochineal, or lac, do not owe their colour to independent cells or corpuscles. Hence, if corpuscles, of the form and size of those found in mammalian blood, are visible under the microscope, there can be no doubt that the liquid is blood. Such evidence can, however, be safely received only from one who has been accustomed to the use of this instrument, and to the examination of blood. In order to examine the suspected substance for corpuscles, the best plan of proceeding, when the particles of coagulum are very small, is to breathe several times on a glass slide, then place the small fragments of coagulum on the slide, and again breathe over them. A thin cover-glass may then be laid upon them. If they consist of blood, a red margin will soon appear, and in the fluid portion, by the aid of a magnifying power of from 300 to 500 diameters, some of the corpuscles of the blood may be recognized. They are seldom so perfectly spherical as in the fresh state, and they appear small, and frequently shrunk or corrugated. In some cases, only fragments of the envelopes can be seen. The condensed moisture of the breath may serve the purpose of water, in breaking up the small portions of dried blood, without destroying the corpuscles by too much dilution, but in general the addition of a small quantity of water with one-tenth of its volume of glycerine, or some other liquid of the sp. gr. 1·028, is necessary.

Fig. 42.

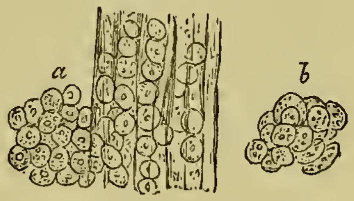


Blood-corpuscle, highly magnified.

If the suspected clot is in larger quantity, it may be removed from the stuff and placed to macerate in one or two drops of water and glycerine, as above, on a glass slide. It should be covered with thin glass, in order to prevent rapid evaporation. This method of extracting the corpuscles has frequently failed, owing to water alone having been employed. Under these circumstances, the corpuscles are distended, become of a globular form, of less diameter, paler, and are finally destroyed, while the water simply becomes coloured. It is by no means easy in all cases to obtain from dry coagula clear and distinct evidence of the presence of these corpuscles, especially when the blood is old. In drying, the blood-cells lose their form, and they do not readily assume it when again moistened. Unless they are seen after a short maceration in a very small quantity of water, it is probable they will not be seen at all. To accelerate their separation, various chemical liquids have been recommended. Thus strong solutions of sulphate of sodium, chloride of sodium, and iodide of potassium have been employed as fluid media for breaking up the dried clots of blood. There are some disadvantages attending the use of these saline solutions. A mixture of glycerine and water may be employed in place of them. The most convenient proportions are one part by measure of glycerine to nine or ten parts by measure of distilled water. A cold saturated solution of borax in water is useful. A solution of arsenious acid, in the proportion of four grains to an ounce of distilled water, as recommended by Kunze, is also a rapid solvent of the coagula. When this is used, the examination should take place as soon as the liquid begins to be coloured at the margin, or the corpuscles may be destroyed, and only fragments of their envelopes seen.

In reference to stains on clothing, if they present any appearance of dry coagula, these should be carefully scraped off, and treated in the manner above described. If no portions of solid coagula can be procured, there will be but little hope of obtaining evidence of the presence of corpuscles in the suspected stain. The stained portion may be cut out and macerated in a small quantity of water. Under these circumstances, the corpuscles may be sometimes seen aggregated, or in groups, in the fibres of the stuff, as in the annexed engraving (Fig. 43), in which the stain of blood was on a shirt.

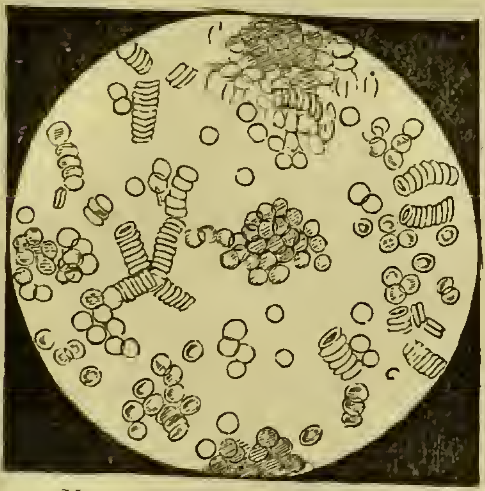
Fig. 43.



a, Corpuscles of blood in linen fibre ; *b*, a group detached.

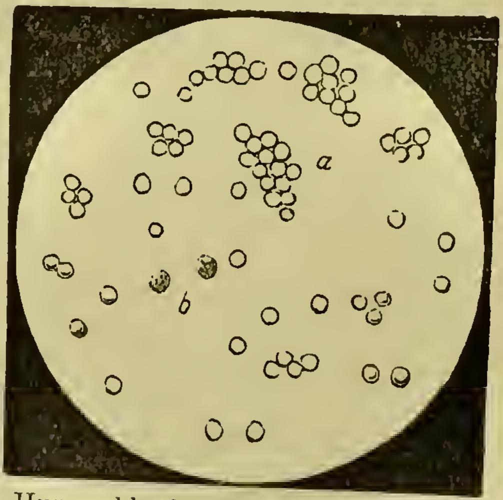
The subjoined illustrations (Figs. 44 and 45) show the appearances presented by blood-corpuscles, when examined by a power of about 300 diameters, and under different methods of treatment. Fig. 44 represents the appearance of a drop of healthy human blood. The red blood-globules are partly detached, partly united in rolls, and partly in irregular clusters. In the vacant spaces between them there are delicate threads of fibrin. The outlines of the blood-globules

Fig. 44.



Human blood-corpuscles with fibrin.

Fig. 45.



Human blood-corpuscles from a dried specimen, magnified 319 diameters.

are rendered, in some instances, indistinct, by reason of this web of fibrin above them.

In Fig. 45 (p. 273), the corpuscles are seen free from fibrin, and in groups (*a*) as well as singly. Only a small portion of those which were in the field have been engraved. The shaded bodies (*b*) are the white corpuscles of the blood; they are larger, but less numerous, not so well defined in form, and they present an irregularity of surface, by which they may be distinguished from the coloured blood-globules.

Some practice in the use of the microscope is required to enable a medical man to arrive at a correct conclusion in these investigations. Granules of starch and the spores of vegetables might be mistaken for blood-corpuscles. Erdmann states that, in examining some articles of clothing in a case of suspected murder, he thought he had detected blood-globules in the liquid which he procured, but he found on further inspection that they consisted of the red-coloured spores of an alga known as the *Porphyridium cruentum.* ('Edin. Med. Jour.,' Oct. 1862, p. 370.) The size of the bodies as well as their shape will sometimes aid the observer. The blood-corpuscles have a definite size: the bodies seen under the microscope may be either too large or too small to fall within the exceptional range of size. Hence the micrometer is a necessary adjunct to the instrument. Granules of starch would be identified by the blue colour imparted by iodine.

Blood of Man and Animals.—When marks of blood have been detected on the dress of an accused person, it is by no means unusual to find these marks accounted for by his having been engaged in killing a pig, bullock, or sheep, or in handling fish or dead game. Of course, every allowance must be made for a statement like this, which can be proved or disproved only by circumstances; but the question here arises whether we possess any *certain* means of distinguishing the blood of a human being from that of an animal.

There are no ascertained *chemical* differences between the blood of man and animals. The red colouring matter, the albumen and fibrin, are the same, and chemical reagents produce on them precisely similar results. The microscopical differences refer to the *shape* and *size* of the corpuscles. 1. With respect to *shape.* In all animals with red blood, the globules have a disc-like or flattened form. In the mammalia, excepting the camel tribe, the outline of the disc is *circular* (Fig. 42 *a*, p. 272). In this tribe, and in birds, fishes, and reptiles, the corpuscles have the form of a lengthened ellipse or *oval.* In the three last-mentioned classes of animals they have a central nucleus, which gives to them an apparent prominence in the centre. In applying the guaiacum process to this variety of blood, it is found that the nucleus acquires a deep blue colour, while the oval margin or envelope is of a violet tint. In mammalian blood the round corpuscle acquires a uniform blue colour. ('Amer. Jour. Med. Sci.,' Jan. 1874, p. 128.) The blood-corpuscles of all the mammalia, including those of the camel tribe, have no central nucleus, and they appear depressed in the centre. The microscope, therefore, enables an observer to distinguish the blood of birds, fishes, and reptiles from that of a human being or from mammalian blood; and this may be of great importance as evidence.

In the case of *Reg.* v. *Libbey* (Cornwall Sum. Ass., 1871), the prisoner, who was indicted for the murder of her child, alleged that some blood found on certain articles of clothing was fowl's blood; but the medical witness was able to prove that this statement was untrue. He examined the stains with the microscope, and found that the corpuscles had not the oval form of those in the blood of a bird; but he was unable to say whether they were human or animal. This evidence tended to prove the falsehood of the defence.

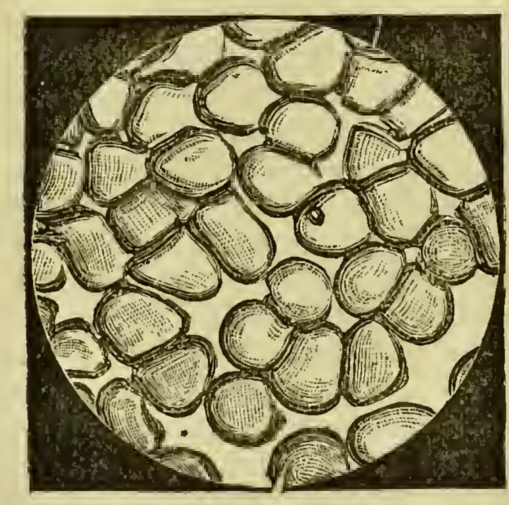
The chief microscopical distinction between the *blood of man and domestic animals* consists in a minute difference in the *diameter* of the corpuscles. This, however, is only an average difference; for the corpuscles are found of different sizes in the blood of the same animal. In making use of this criterion, it would be necessary to rely upon the size of the majority of the corpuscles seen in a given area, and under the same power of the microscope. It is a curious fact that their size bears no relation to the *size* of the animal. Thus, in the horse, ox, ass, cat, mouse, pig, and bat, they are, on an average, nearly of the same size; the difference is so slight as to be practically inappreciable. In these animals they are smaller than in man and in several of the mammalia. The corpuscles in man, the dog, the rabbit, and the hare are of nearly the same size. In the blood of the sheep and goat they are much smaller than in other mammalia, while in man they are larger than in any of the domestic mammalia. The size of the corpuscles bears no proportion to the *age* of the animal: thus in the blood of the human fœtus, they are to be found as large as in that of the adult.

The measured diameter of the corpuscles in *human blood* varies, according to Gulliver, from 1-2000th to 1-4000th of an inch (0·00050 to 0·00025 inch), the average size in both sexes being 1-3200th (0·00031) of an inch. In fresh human blood the author found the average diameter of the corpuscles to be 1-3500th (0·00029) of an inch, the maximum size being 1-3000th (0·00033), and the minimum 1-5000th (0·00020) of an inch. The corpuscles of human blood are larger than those of domestic animals. The subjoined measurements, in fractions of an inch, are those given by Gulliver, excepting those given in italics, which are from the author's own observations. The average diameter is, in the dog, 1-3540th (0·00029), *max. 1-4000th (0·00025), min. 1-6000th (0·00017)*; in the hare, 1-3607th (0·00028), *max. 1-2000th (0·00050), min. 1-8000th (0·00012), average 1-4000th (0·00025)*; *in the rabbit, 1-4000th (0·00025)*; in the mouse, 1-3814th (0·00023); in the ass, 1-4000th (0·00025); in the pig, 1-4230th (0·00022), which accords with *the author's measurements, 1-4250th*; in the ox, 1-4267th (0·00022); *in the cow, 1-4000th (0·00025) to 1-4200th (0·00022)*; in the cat, 1-4400th (0·00023); in the horse, 1-4600th (0·00022) *or 1-5000th (0·00020)*; in the sheep, 1-5300th (0·00019), *or 1-5333rd to 1-6000th (0·00019 to 0·00016)*; in the goat, 1-6366th (0·00016). These measurements apply to *recent* blood, which has not been allowed to become dry on animal and vegetable stuffs. I this case a distinction might be easily made between the blood of a human being and a sheep or goat. With respect to the dog, hare, and rabbit, it would be, even under these favourable circumstances, a matter of some difficulty. When blood is dried on clothing, and it is necessary to extract the corpuscles by means of a liquid of a different nature from the serum, it would be unsafe to rely on minute fractional differences, since we cannot be sure that the corpuscles, after having been once dried, will ever reacquire, in a foreign liquid, the exact size which they had in serum. (See 'Guy's Hosp. Rep.,' 1851, vii. pt. ii. p. 414.)

It is generally admitted by scientific men that we have at present no certain method of distinguishing human from other mammalian blood, when it has been once dried on an article of clothing or on a weapon. This is the practical form in which the problem usually comes before a medical jurist. He may be able to state that the shape and size of the corpuscles, as seen by the microscope, are consistent with the blood being mammalian, and probably human, but that it is impossible to say with absolute certainty that it is not the blood of an animal like the ox or pig.

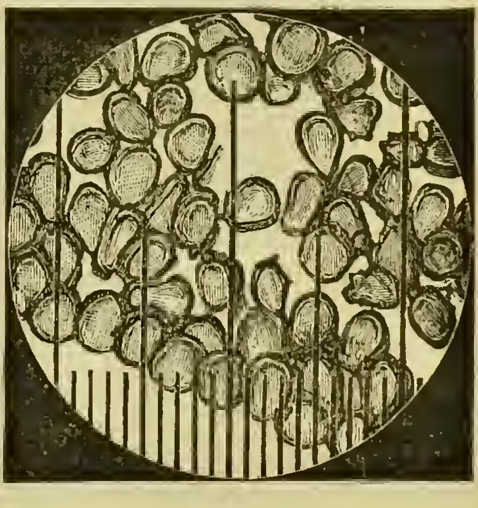
Richardson, of Philadelphia, U.S., has made a considerable step in advance on the microscopical examination of blood. ('Amer. Jour. Med. Sci.,' July 1874.) By the use of higher powers up to 750 diameters, and by other appliances, he asserts that he has been able to distinguish, under favourable conditions, the blood of man from that of such animals as the ox and pig, and to give evidence thereon on certain trials for murder.

Fig. 46.



Human corpuscles, 1-3500th.

Fig. 47.



Pigs' corpuscles, 1-4250th.

It will be understood that, as the magnifying power increases, the relative difference in the size of the corpuscles is more apparent. Thus, when at 300 diameters it would be scarcely possible to distinguish the blood of man from that of the pig, at 650 diameters the difference in size is well marked. The plates (Figs. 46 and 47), taken from a photograph by Seiler, represent, under the same power (650 diameters), the corpuscles in the blood of man and the pig. In each of the engravings only a small portion of the blood is represented, the whole of the photograph, with the two varieties of blood and the micrometric scale, being much too large for a page of this work. Seiler's process is described in the 'Amer. Med. Times,' Feb. 19, 1876, p. 249. The larger size of the corpuscles in human blood (Fig. 46) is at once perceptible, and it may be observed that the smallest of the human corpuscles thus highly magnified is larger than the largest of those in the pig (Fig. 47). This observation was made on fresh blood, for Seiler candidly admits that he has not been able to obtain satisfactory results with dried blood-stains, the problem which in practice most commonly presents itself for solution.

From one well experienced in the use of the higher powers of the microscope, evidence of the probable nature of the blood might be receivable, but skilled experts of this kind are rarely found among medical witnesses, and when the blood is dried the evidence is generally inadmissible.

In all cases in which the microscope is employed for the examination of blood-corpuscles, a comparison of the sample should always be made with the kind of blood, whether human or animal, which it is supposed to represent.

In general it is found sufficient if the witness can say that the blood-stains on an article of dress have the characters of mammalian blood, and might be the blood of a human being. The blood of birds, fishes, and reptiles presents no difficulty, and in trials for murder the statement of a prisoner is occasionally proved false by the medical evidence derived from the microscope (*Reg.* v. *Libbey*, see p. 275). A prisoner was charged (*Reg.* v. *Ward*, Leeds Ass., Nov. 1878) with murder and highway robbery. The deceased was found dead, with marks of severe blows on the head. Among other circumstances which connected the prisoner with this crime was a large spot of blood upon his trousers. When asked to account for this, he said it was the blood of a fowl. The medical witness was able to state that this was not the blood of a bird, but of a mammal. Poachers have their clothes often stained with blood in contests with gamekeepers. The stains have in these cases been sometimes referred to the carrying of pheasants or partridges, but the medical evidence has shown that the form of the corpuscles was inconsistent with this defence.

Stains of Blood on Linen and other Stuffs. Their Age or Date.—Supposing the stuff to be white, or nearly colourless, the spot of blood, if *recent*, is of a bright-red colour; but by exposure it sooner or later becomes of a reddish-brown, or of a deep red-brown colour. This change of colour to a reddish-brown takes place in warm weather in less than twenty-four hours. After a period of five or six days, it is scarcely possible to determine, from the appearance, the *date* of a stain even conjecturally. In a large stain of blood on linen, no change took place during a period of five years: it had a reddish-brown colour at the end of six weeks, which it retained for the long period mentioned. Indeed, it is extremely difficult in any case, after the lapse of a week, to give an opinion as to the actual date of a stain. Upon coloured stuffs or dirty clothes, it is, of course, impossible to trace these physical changes in stains of blood; on red-dyed stuffs the stain appears simply darker from the first, and in all cases the fibre of the stuff is more or less *stiffened*, as a result of the drying of the albumen associated with the red colouring matter. In examining an article of clothing, attention should be paid to the side of the stuff which has first received the stain: sometimes both sides are stained. The evidence derived from an observation of this kind may be occasionally of importance.

The suspected stain should be first examined, in a strong light, with a low power of the microscope. If caused by blood, it will not be a mere colouring of the fibres, but it will have a shining glossy appearance, and each fibre will be observed to be invested with a portion of dried coagulum, or clot. In other cases, minute coagula, presenting the appearance of dried red jelly, will be seen in the meshes of the stained article of clothing. In certain lights the clots may appear of a dark-red colour, but by changing the light, bright translucent portions of a peculiar crimson tint will come into view. The crimson stain of blood is unlike that of any other red colouring matter, and when the stained portion presents the character of a glossy dry coagulum, the stain cannot be easily mistaken by a practised eye for one caused by any other red-coloured liquid. In fact, the microscope puts the observer of a minute stain in the same position as a non-professional person, who unhesitatingly forms his judgment from a large quantity of dried blood. Portions of kino over a dress may present occasionally the appearance of coagulated blood, but kino differs in colour and in chemical properties from blood. The microscopical observation of a suspected stain on linen, cotton, or woollen, however small, is generally sufficient to enable an expert to form an opinion either in the affirmative or negative. The application of chemical and spectroscopical tests should, however, be resorted to for confirmatory evidence.

Analysis.—If the quantity of blood is small, the stained substance may be cut up and macerated in a porcelain capsule, with just enough water to keep it well moistened. After an hour it may be pressed, and a red-coloured liquid will be thus obtained in a fit state for testing. The editor finds that a cold saturated solution of borax is the best solution generally for dissolving the blood-pigment from blood-stains. This solution, having a density of 1·020, rather less than that of blood-serum, is well adapted for the examination of stains for blood-corpuscles under the microscope. A solution of borax quickly dissolves blood-pigment from leather, iron, and soil; and, moreover, acts as a preservative, so that the solution retains its characters for several days. It may be objected that red stains resembling blood are occasionally found on linen and other stuffs, and may give rise to error. All such stains are either entirely insoluble in water, or they are soluble and yield red-coloured liquids. If *insoluble*, they cannot be mistaken for blood-stains; if *soluble*, no mistake can arise provided the red liquid so obtained is submitted to chemical tests. Blood-stains rendered insoluble in water, by heat or from some other cause, must be tested by another method. When the stain is of *old date*, a solution in water is very slowly obtained, and it does not present the bright-red colour of blood. In some cases, if the stain is of very old standing, and has been much exposed to the atmosphere, water will have scarcely any solvent effect upon it, and it may be found impossible to obtain a red-coloured liquid even after twenty-four hours' maceration. At the most the water may acquire a pale-brown or yellowish colour, but wholly unlike that imparted by blood. In such a case it is useless to add ammonia. We may, however, generally form a correct judgment by the microscopical appearance of the stain before wetting it, and by the guaiacum process. Water may dissolve sufficient albumen (or serum) to become opaline by *heat*, or by the addition of nitric acid, although we may fail to obtain any evidence of the presence of corpuscles. From the results obtained by spectral analysis, it appears probable that acid and other vapours in the atmosphere affect blood-stains and alter their chemical properties. Where much coal is burnt, sulphurous acid may operate in this manner. Under other circumstances, when the quantity of blood effused is moderately large, it may be detected by the process above mentioned after the lapse of a considerable time. We have thus detected the blood of the human body, and of the bullock, on cotton, linen, and flannel, after a lapse of *three years*. The spectroscopic test should also be applied, and the bands of either hæmoglobin, or of hæmochromogen, or of both bodies obtained, if possible. A portion of the fabric may also be treated with acetic acid for the obtaining of hæmin-crystals (see p. 271, *ante*). If the stuff be dyed, we should proceed to examine the stains found upon it by a similar process. The dye is commonly fixed, and is not soluble in water. Thus, then, in testing for blood we rely upon: 1. The solubility of the red colouring matter in water. 2. The negative action of ammonia. 3. The positive effect of heat in entirely coagulating and destroying the red colouring matter. 4. The blue colour produced by guaiacum in the presence of peroxide of hydrogen. 5. The appearances of the spectrum. 6. The production of hæmin-crystals. 4, 5, and 6 are the most important reactions of blood.

There are red stains bearing a resemblance to blood, which are *insoluble* in water. These may be identified by their special characters. Among them are: 1. Certain *red dyes*, as madder, which, when fixed by a mordant, is not readily affected by ammonia. 2. *Iron-moulds*. These are of a reddish-brown colour, sometimes of a bright or orange-red; they are quite insoluble in water, but are easily dissolved by maceration in diluted hydrochloric acid, and on adding ferrocyanide of potassium to the solution, the presence of iron will be at once proved by the production of Prussian blue. The acid used for this purpose should contain no iron. Iron-moulds are generally distinguished by their brown colour, and by the absence of all stiffening or glossiness of the fibre in the stained spot. 3. *Red paint*. Stains made with red paint, containing red oxide of iron, have been mistaken for blood. They may be easily identified by digesting them in diluted hydrochloric acid, and applying to the solution the tests for ferric salts. Like those produced by iron-moulds, they are quite insoluble in water, and therefore cannot be confounded with blood-stains. The same may be said of spots of the ammonio-nitrate of silver changed by light, which the author has known to be mistaken for old stains of blood. The stuff on which the spots of blood are found may be itself stained with a red dye or colour, or it may be dyed with iron: in this case it will be necessary to test by the same process a piece of the coloured or stained portion, in order to furnish negative evidence that the suspected stains are due to blood. 4. Among *soluble* stains resembling those of blood in colour, are the spots produced by the juices of the *mulberry*, *currant*, *gooseberry*, and other *red fruits*. They may be sometimes recognized chemically by dropping on them a weak solution of ammonia, when the spot is turned either of a bluish, olive-green, or green colour. The red of cochineal is changed into a crimson on the addition of *weak* ammonia; but a spot of blood treated with this alkali undergoes no change of colour. Eosin, used as a red ink, gives a solution to water which is strongly fluorescent. Diluted acids brighten the red colours of fruit-stains, but they do not alter the colour of blood. A strong solution of chlorine bleaches the red colours from fruit-stains, but when applied to a stain of blood it turns the red colouring matter of a dark olive-green tint and does not bleach it. Finally, they are not coloured blue by tincture of guaiacum with peroxide of hydrogen.

These changes of colour are only well observed on colourless stuffs. If the stain is on black cloth, the colour may be extracted by water and tested, or the following plan may be adopted: the stain is wetted with distilled water, and after a time several layers of white blotting-paper are firmly pressed upon it. The red colour, if present, is thus transferred to the paper, and may be tested by fresh tincture of guaiacum and peroxide of hydrogen. If the guaiacum alone is blued by contact, some other method of corroboration must be adopted, since the red colour of blood has no action on this resin until after the addition of peroxide of hydrogen. If no red or reddish-brown colour is communicated to the paper, or if the stain on paper produces no blue colour with a mixture of guaiacum and peroxide, it cannot be owing to blood. With ordinary precautions the guaiacum process may be safely used, and, by the aid of it, stains which have been *washed* for the purpose of obliteration may be detected, so long as the slightest indication of red colour remains in the washed fabric. It will even give the reactions for blood upon calico or linen which has been so thoroughly washed as to appear almost colourless. In order to guard against any fallacy, an *unstained* portion of calico, linen, paper, or cloth should be first tested. In any case a negative result will fully justify the opinion that there have been no blood-stains washed out of the stuff. The great use of the guaiacum process is in enabling the operator to distinguish the *red* colouring matter of blood from other *red* colouring matters.

Detection of Blood on Weapons.—A knife, dagger, or sword may have been used for inflicting a wound, and may have no stain upon it, or only a slight yellowish film of dried serum. It may, in fact, have been wiped by drawing it through the wound or clothes. In other cases the weapon may have well-marked stains upon it, and when these are recent and on a clean or polished surface, they may be easily recognized; but when of old standing, or on a rusty piece of metal, it is a matter of some difficulty to distinguish them from the stains produced by rust or other causes. If the stain is large and dry, a portion may be scraped off, and placed in a watch-glass with some distilled water, the solution filtered to separate any oxide of iron, and then tested. If the water by simple maceration does not acquire a red or red-brown colour, the stain is probably *not* due to blood. If it acquires a red colour, the solution may be tested by the methods described at p. 279. Sometimes the stain appears on a dagger or knife, either in the form of a thin yellowish or reddish film, or in rusty streaks. The dry matter is scraped into a small porcelain dish and a little water poured on it. If a red-coloured solution is obtained, this may be poured off and tested for blood. The residue, evaporated to dryness, may be treated with guaiacum and peroxide of hydrogen. The particles of blood are thus distinguished from those of iron-rust by the small zones of blue colour formed around them. The rust is not thus affected. There is a remarkable resemblance to the stains of blood on metal, produced by the *oxides or certain vegetable salts of iron.* If the juice or pulp of lemon or orange is spread upon a steel blade, and is exposed to the air for a few days, the resemblance to blood produced by the formation of *citrate of iron* is occasionally so strong that we have known well-informed surgeons to be completely deceived: they have pronounced the spurious stain to be blood. These stains, which owe their colour to *citrate of iron*, may be thus distinguished: the substance is soluble in water, forming, when filtered, a yellowish-brown solution, totally different from the red colour of blood under the same circumstances. The solution undergoes no change of colour on the addition of ammonia. It is unchanged in colour, but may be partially coagulated at a boiling temperature, and it is at once identified as a soluble salt of iron by giving a blue colour with ferrocyanide of potassium.

It is not always easy to distinguish by sight a stain of blood on a weapon from a mark produced by *iron-rust.* When strong suspicion exists, marks are often pronounced to be due to blood, which, under other circumstances, would have passed unnoticed. One source of difficulty is this: the iron-rust on an old knife may be mixed with some article of food or even with blood itself. We must here pursue the mode of examination above described to distinguish the rust from blood (p. 279). From the foregoing remarks, we may justly infer that the chemical analysis of suspected spots or stains on weapons and clothing is by no means an unimportant duty. If we cannot always obtain from these experiments affirmative evidence, they often furnish good negative proof, and thus tend to remove unjust suspicions against accused persons.

Arterial and Venous Blood.—It is not possible to distinguish *arterial* from *venous* blood by any physical or chemical characters, when it has been for some days effused, and is in a dry state upon articles of dress or furniture; but this, in medico-legal practice, is not often a subject of much importance, since there are few cases of severe wounds, either in the throat or other parts of the body, in which the two kinds of blood do not escape simultaneously. The most striking and apparent difference between them, when recently effused, is the *colour;* the arterial being of a bright scarlet, while the venous is of a dark-red hue; but it is well known that the latter, when exposed to air for a short time, acquires a florid red, or arterial, colour; and the kinds of blood, when dried, cannot be distinguished chemically by any known criterion. If the coat, or other stuff, stained with blood, were of a dark colour, the liquid would be absorbed, and speedily lose its physical characters. Arterial coagulates more firmly than venous blood. The microscope shows no appreciable difference in the blood-corpuscles, and chemistry does not enable us to apply any test so as to make a satisfactory distinction between them. In this deficiency of microscopical and chemical evidence, an attempt has been made to establish a distinction by noticing the physical appearance of the blood-stains. Thus, it is alleged, the arterial blood will be indicated by its being *sprinkled* over surfaces upon which it has fallen, while the venous blood is always poured out in a full stream. In most wounds which prove fatal by hæmorrhage, the blood is poured out simultaneously from arteries and veins. The sprinkled appearance of the blood, when it exists, will, *cæteris paribus,* create a strong presumption that it was poured out from a *living* body—for after the heart has ceased to act, the arteries lose the power of throwing out the blood in jets. The sprinkling is usually observed when the wounded artery is small, and the blood is effused at a distance. This is a fact which a medical jurist should not overlook, although, for the reasons stated, too great a reliance must not be placed on it. The spots of blood, if thrown out from a living blood-vessel, speedily consolidate, and the fibrin, with the greater portion of the colouring matter, is found of a deep-red colour at the lower part of the spot, the upper portion being of a pale red. The lower and thicker part has commonly a shining lustre, as if gummed, when the spot is recent, and when it has been effused upon a non-absorbent surface.

When blood falls upon porous articles of clothing, it is often absorbed, and produces dull stains. In dark-coloured articles of dress, it is sometimes difficult by daylight to perceive these stains. The part appears stiffened, and has a dull red-brown colour, which is sometimes more perceptible when seen by the reflection of the light of a candle. In trusting to the coagulation of the sprinkled blood as evidence of its escape from a living vessel, it must be remembered that three hours may elapse before it coagulates in the healthy body after death. Hence blood which has escaped from a recently dead body, although it would not be found diffused as if by spurting, might, in so far as coagulation is concerned, assume the appearance of having been effused from a living body.

In spite of the great advances made in the construction and use of the microscope, there is no method known by which the blood of a man can be distinguished from that of a woman, or the blood of a child from that of an adult. The blood of a child at birth forms a thinner and softer coagulum than that of the adult. A medico-legal question has arisen, on more than one occasion, whether there were any means of distinguishing *menstrual* blood from that of the body generally. This liquid contains fibrin, although the proportion is less than in venous or arterial blood, red colouring matter, and the other constituents of blood. The only differences noticed are of an accidental kind: first, that it is acid, owing to its admixture with vaginal mucus; and second, that under the microscope it is mixed with epithelial scales, which it has derived from the mucous membrane in its passage through the vagina. In the bodies of women who had died suddenly while menstruating, Webber found coagulated blood upon the uterine mucous membrane. If, therefore, menstrual blood does not coagulate, it is simply because it has already coagulated within the uterine cavity, and cannot do so again; it is more fluid than ordinary blood, because, during its trickling descent, it becomes mixed with watery uterine and vaginal mucus. (Schmidt's 'Jahrb.,' 1847, 7, 139.) A case occurred in France, which induced the Minister of Justice to refer the consideration of this question to the Academy of Medicine. The reporters, Adelon, Moreau, and Le Canu, came to the conclusion that there were no means of distinguishing menstrual blood dried on clothing from that which might be met with in a case of infanticide or abortion. ('Ann. d'Hyg.,' 1846, t. 1, p. 181.)

For a very full description of the methods to be adopted in the examination of supposed blood-stains under various circumstances, the reader is referred to a recent memoir by Dragendorff. (Maschka's 'Handb. der Gerichtl. Med.,' bd. i. p. 481, *et seq.*)

CHAPTER 28.

THE CAUSE OF DEATH FROM WOUNDS.—WOUNDS DIRECTLY OR INDIRECTLY FATAL.—DEATH FROM HÆMORRHAGE.—INTERNAL BLEEDING.—DEATH FROM MECHANICAL INJURY.—FROM SHOCK.—DEATH FROM NUMEROUS PERSONAL INJURIES IRRESPECTIVE OF ANY MORTAL WOUND.

It is important for a medical witness to bear in mind that, in all cases of wounds criminally inflicted, the cause of death must be *certain*. No man is ever convicted upon mere medical probability. In general, there is only *one* real cause of death, although other circumstances may have assisted in bringing about a fatal result. Thus a person cannot die of disease in the bowels and a stab in the chest at the same time, nor of apoplexy from disease and compression of the spinal marrow at the same instant. Hence it is our duty, when several apparent causes for death exist, to determine which was the *real* cause; and, in stating it to the court, to be prepared to offer our reasons for this opinion. In most cases of local injury, when a person dies speedily, there will be no great trouble in settling whether disease or the injury was the cause. A difficulty may, however, exist when a person has recovered from the first effects of a wound, and has subsequently died. Besides, there may be cases in which the cause of death, in spite of the most careful deliberation, will be still obscure; or sometimes it may happen that the death of a person appears to be as much dependent on bodily disease as on an injury proved to have been received at the time he was labouring under the disease. How is an opinion to be expressed in such a case? The course that a medical witness ought to pursue, provided he has duly deliberated on the circumstances before he appears in court, and his mind is equally balanced between the two causes, is to state at once his doubt to the jury without circumlocution, and not allow it to be extracted from him in cross-examination. It is the hesitation to assign a satisfactory cause, or the assigning of many causes for death, that gives such advantage to a prisoner's case, even when the general evidence is entirely against him. Occasionally, several causes of death are vaguely assigned by a medical witness, among which some have a tendency to exculpate, and others to inculpate, an accused person in a greater or less degree, and it is left to the jury to select from the number one upon which to found a verdict. In a case of this kind an acquittal is commonly obtained.

Wounds directly or indirectly Fatal.—A wound may cause death either directly or indirectly. A wound operates as a *direct cause of death* when the wounded person dies either immediately, or very soon after its infliction, and there is no other cause, internally or externally, to account for death. In wounds which cause death *indirectly*, it is assumed that the person survives for a certain period, and that the wound is followed by inflammation, suppuration, pyæmia, gangrene, tetanus, erysipelas, or some other mortal disease which is a direct, and not an unusual, consequence of the injury. Under this head may be also placed all those cases which prove fatal by reason of surgical operations rendered imperatively necessary for the treatment of an injury—presuming that these operations have been performed with ordinary skill and care. We shall for the present consider only the direct causes of death in cases of wounds. They are three in number:—1. *Hæmorrhage*, or loss of blood. 2. *Great mechanical injury* done to an organ important to life. 3. *Shock*, or concussion, affecting the nervous centres, whereby the functions of one or more vital organs are arrested, sometimes with but slight injury to the part struck or wounded. From any one of these causes a wounded person may die immediately or within a few minutes.

1. *Death from Hæmorrhage.*—Loss of blood operates by producing fatal syncope (p. 36). A quantity of blood escaping from a vessel, although insufficient to cause death by affecting the heart and circulation, may readily destroy life by disturbing the functions of the organ or part into which it is effused. Thus a small quantity effused in or upon the substance of the brain, or at its base, may prove fatal by inducing fatal compression; and again, if in a case of wounded throat, blood should flow into the windpipe, it may cause death by

asphyxia; *i.e.* by stopping the respiratory process (p. 36). In these cases it is obvious that the blood acts mechanically; and in respect to the last condition a medical man, unless circumspection is used, may involve himself in a charge of malapraxis. If he allows the wound to remain open, the wounded person may die through hæmorrhage; if he closes it too soon, the person may die through suffocation; and, in either case, the counsel for a prisoner will not fail to take advantage of a plausible objection of this kind. In wounds of the chest, involving the heart and lungs, death is frequently due, not so much to the actual quantity of blood effused, as to the pressure which it produces upon these organs. A few ounces effused in the cavity of the bag enclosing the heart (pericardium) will entirely arrest the action of this organ.

The absolute *quantity of blood* required to be lost in order to prove fatal, will, of course, vary according to numerous circumstances. The young, the aged, and those who are labouring under infirmity or disease, will perish sooner from loss of blood than others who are healthy and vigorous. Women, *cæteris paribus*, are more speedily destroyed by bleeding than men. Infants are liable to die from this cause, as a result of slight wounds. An infant has been known to bleed to death from the bite of a single leech, or from the simple operation of lancing the gums. Even the healthy and vigorous, when their vital powers have been depressed by maltreatment or by brutal violence, will sink under the loss of a comparatively small quantity of blood. A medical jurist must not forget that some persons have a predisposition to excessive bleeding from slight injuries; and this condition is often hereditary. The slightest wound or puncture—the bite of a leech or the extraction of a tooth—will be attended with a loss of blood which cannot be arrested, and which will slowly lead to death by exhaustion. Cases have been frequently recorded of fatal hæmorrhage following the extraction of teeth, when there had been previously nothing to indicate the probable occurrence of death from so trivial a cause. Such cases are without difficulty detected; since a surgeon may always infer, from the part injured and the extent of the injury, whether the bleeding is likely to be copious or not. When a person bleeds to death from what would, under common circumstances, be a simple wound, the admission of this fact may in certain cases lessen the responsibility of an accused party.

A *sudden loss* of blood has a much more serious consequence than the same quantity lost slowly. A person may fall into a fatal swoon from a quantity of blood lost in a few seconds, which he would have been able to bear without sinking had it escaped slowly. This is the reason why the wound of an artery proves so much more rapidly fatal than that of a vein. Death speedily follows the wound of a large artery like the carotid; but it takes place with equal certainty, although more slowly, from wounds of smaller arteries. In a case in which one of the intercostal arteries was wounded by a small shot, hæmorrhage caused death in thirty-eight hours. The loss of blood which follows the division of the smaller branches of the external carotid artery is often sufficient to destroy life, unless timely assistance be rendered. If a wound is in a vascular part, although no vessel of any importance be divided, the person may still die from bleeding. It is difficult to say what *quantity* of blood should be lost in order that a wound may prove fatal. The whole quantity contained in the body of an adult is estimated at about one-thirteenth of its weight—*i.e.* about twelve pounds; of this, one-fourth is considered to be distributed in the heart, lungs, large arteries, and veins. In various animals, the proportion of the weight of the blood to that of the body has been found to vary considerably; and probably this holds good for man also, within certain limits. (Foster's 'Text-Book of Physiology,' p. 34.) According to Watson, the loss of from five to eight pounds is sufficient to prove fatal to adults. But while this may be near the truth, many persons will die from a much smaller quantity; the *rapidity* with which the effusion takes place having a considerable influence, as well as the age, sex, and bodily condition of the wounded person. It has been found, by experiment, that a dog cannot bear the loss of more blood than is equivalent to one-twelfth part of the weight of its body.

Internal Hæmorrhage.—Hæmorrhage may prove fatal, although the blood does not visibly escape from the body. In incised wounds, the flow externally is commonly abundant; but in contused, punctured, and gunshot-wounds, the effusion may take place internally and rapidly cause death. In severe contusions, or contused wounds involving highly vascular parts, the effusion may go on to an extent to prove fatal, either in the cavities of the body or throughout the cellular membrane and parts adjacent; several pounds of blood may thus be slowly or rapidly effused. The most fatal internal hæmorrhages are those which follow ruptures of the organs from violence or disease. Ruptures of the heart, lungs, liver, and kidneys have thus caused death. In Nov. 1864, a man who had been run over was brought to Guy's Hospital. He complained of pain in the back, but there were no symptoms of severe injury, and no marks of violence were seen on the skin of the back. He left the hospital, and walked with some assistance to his home. A few hours afterwards he was found dead in bed. On inspection there was a large quantity of blood effused in the abdomen. This had proceeded from one kidney, which had been ruptured transversely through its whole substance. In these cases the bleeding is not necessarily immediate; but slight muscular exertion may increase it and accelerate death. In death from severe flagellation, blood may be effused in large quantity beneath the skin and among the muscles: this effusion will operate as fatally as if it had flowed from an open wound.

The means of ascertaining whether a person has died from bleeding by an open wound are these: unless the wound is situated in a vascular part, we shall find the vessel or vessels from which the blood has issued, divided; the neighbouring vessels empty, and the body more or less pallid; although this last condition is, of course, liable to be met with in certain cases of disease, as also under copious venesection—points easily determined by an examination. The blood will commonly be found more or less clotted or coagulated on those surfaces on which it has fallen. If, with these signs, there is an absence of disease likely to prove rapidly fatal, and no other probable cause of death is apparent, this may be fairly referred to loss of blood. This opinion may, however, be materially modified in reference to open wounds, by the fact of the body not being seen on the spot where the injury was actually inflicted, by the wound having been sponged, the blood removed by washing, and all traces of bleeding destroyed. Under these circumstances, the case must in a great measure be made out by presumptive proof; and here a medical witness may have the duty thrown upon him of examining articles of dress, furniture, or weapons, for marks or stains of blood. It must not be supposed that all the blood met with round a wounded dead body, or in a cavity of the body, was actually effused during life. As soon as the heart's action ceases, the arteries pour out no more; but the blood, so long as it remains liquid, *i.e.* from four to eight or ten hours after death, and the warmth of the body is retained, continues to drain from the divided veins and smaller vessels. The quantity thus lost, however, is not considerable, unless the veins implicated are large, or the part is highly vascular, *i.e.* full of veins or small vessels.

2. *Death from Great Mechanical Injury done to a Vital Organ.*—We have instances of this becoming a direct cause of death in the crushing of the heart, lungs, or brain, by any heavy body passing over or falling on the cavities, as in railway accidents. The severe mechanical injury is sometimes accompanied by a considerable effusion of blood, so that the person really dies from hæmorrhage; but in other instances the quantity of blood lost is inconsiderable, and the fatal effects may be referred to shock to the nervous system. Sometimes a slight amount of violence may prove suddenly fatal. These are, however, to be regarded as exceptional instances.

3. *Death from Shock.*—This is sometimes a direct cause of death under the infliction of external violence; and in this case life is destroyed without the injury being to all appearance sufficient to account for so speedily fatal a result. On several occasions persons have died in railway collisions from no physical injury, but from pure shock to the system. In a collision, which took place in 1873 at the Durham station, a *Mrs. Coble* was among the dead. On a post-mortem examination there was no appearance of external or internal violence. Savory has suggested that death from shock is nothing more than death from temporary exhaustion of nerve-force, the result of a violent, sudden, and excessive expenditure of it. ('Lect. on Life and Death,' p. 171.) Whatever theory may be adopted to explain it, there is no doubt that a person may die from what is termed shock, without any marks of severe injury being discovered on his body after death. We have examples of this mode of death in accidents from lightning, or from severe burns or scalds, in which the local injury is often far from sufficient to explain the rapidly fatal consequences. As instances of this form of death from violence, may be also cited those cases in which a person has been suddenly killed by a blow upon the upper part

of the abdomen or on the pit of the stomach, an accident which is supposed to operate by producing a fatal impression on the nerves and nerve-ganglia of the cardiac plexus. Whether this be or be not the true explanation, it is admitted by experienced surgeons that a person may die from so simple a cause without any mark of a bruise externally, or physical injury internally to account for death. On the skin there may be some abrasion or slight discoloration; but, as it has been elsewhere stated, these are neither constant nor necessary accompaniments of a blow. Concussion of the brain, unattended by visible mechanical injury, furnishes another example of this kind of death. A man receives a severe blow on the head; he falls dead on the spot, or becomes senseless and dies in a few hours. On an inspection, there may be merely the mark of a bruise on the scalp; in the brain there may be no rupture of vessels or laceration of substance, and all the other organs of the body may be found healthy. In railway accidents persons have died under somewhat similar circumstances. There has been no physical indication of a mortal injury, and no cause apparent to account for death. This can be referred only to the shock or violent impression which the nervous system has sustained from the blow or violence—an impression which the vital powers were wholly unable to counteract or resist. A medical witness must give his evidence with caution in such cases; since it is the custom to rely in the defence upon the absence of any visible *mortal* wound or physical injury to account for death, as a proof that no injury was done—a principle which, if once unrestrictedly admitted, would leave a larger number of deaths, undoubtedly occurring from violence, wholly unexplained.

There is another form of shock, which is of some importance in medical jurisprudence. A person may have received *many injuries*, as by blows or stripes, not one of which, taken alone, could, in medical language, be termed mortal; and yet he may die directly from the effects of the violence, either on the spot, or very soon afterwards. In the absence of any large effusion of blood beneath the skin, death is commonly referred to exhaustion; but this is only another mode of expression; the exhaustion is itself dependent on a fatal influence or impression produced on the nervous system. A prize-fighter, after having sustained during many rounds numerous blows on the body, may either at or after the fight sink and die exhausted. His body may present marks of bruises, or even lacerated wounds, but there may be no internal changes to account for death. In common language, there is not a single injury which can be termed *mortal*; and yet, supposing him to have had good health previously to the fight, and all marks of disease indicative of sudden death to be absent, it is impossible not to refer his death to the direct effect of the violence. It is a well-ascertained medical fact, that a number of injuries, each comparatively slight, are as capable of operating fatally, as any single wound whereby some blood-vessel or organ important to life is directly affected. Age, sex, constitution, and a previous state of health or disease, may accelerate or retard the fatal consequences. In *Reg.* v. *Slane* and others (Durham Wint. Ass., 1872), it was proved that the deceased had sustained severe injuries to the abdomen by kicks and other violence, but there were no marks of bruises. On a post-mortem examination, all the organs were healthy. Nevertheless, death took place twenty minutes after the maltreatment. Death was attributed to shock, and the prisoners were convicted of murder. A case of manslaughter involving this question was tried (*Reg.* v. *McGowan* and others, Leicester Ass., Nov. 1877), where three men were charged with the murder of the deceased. It was proved that he had been maltreated by kicking, and by blows inflicted with heavy stones. He died in four days, obviously from the effects of the violence. The medical evidence showed that the nasal bones were much fractured as by a blow from a heavy stone, and that there were fractures of one clavicle and of several ribs. The witness assigned the cause of death to shock to the system, from the number of injuries received and the inflammation set up by them. The whole of the injuries in his opinion combined to cause death. The prisoners were convicted.

From these considerations, it is obviously unreasonable to expect that in every case of death from violence or maltreatment there must be some specific and visible *mortal injury* to account for this event. When the circumstances accompanying death are unknown, a medical opinion should certainly be expressed with caution; but if we are informed that the deceased was in ordinary health and vigour previous to the infliction of the violence, and there is no morbid cause to account for his *sudden* illness and death, there is no reason why we should hesitate in referring death to the effects of a number of injuries. Among non-professional persons an unfounded prejudice exists that no person can die from violence unless there is some distinctly *mortal* wound actually inflicted on the body. By this we are to understand a *visible* mechanical injury to some organ or blood-vessel important to life; but this is obviously an erroneous notion, since death may take place from the disturbance of the functions of an organ important to life, without this being necessarily accompanied by a perceptible alteration of structure. The prevalence of this popular error often leads to a severe cross-examination of medical witnesses. Among the questions put, we sometimes find the following:—Would you have said, from the wounds or bruises *alone*, that they were likely to have occasioned death? Now, in answer to this it may be observed that we cannot always judge of the probability of death ensuing, from the appearance of external violence alone. Because the appearances were slight, it would be wrong to infer that they were *not* sufficient to cause death by shock. Then it may be inquired—Were the wounds or bruises mortal? In the vulgar sense of the word, *i.e.* by producing great loss of blood, or a destruction of parts, they might not be so; but in a medical view they may have acted mortally by producing a shock to the nervous system. Again it may be inquired—Which of the several wounds or bruises found on the body of the deceased was mortal? The answer to this question may be, not one individually, but *all* contributed to occasion death by syncope or exhaustion. It must be remembered that in cases in which a person has sustained a number of injuries, the loss of a much smaller quantity of blood than in other instances will suffice to destroy life.

When there are several wounds, it is difficult to decide on their relative degree of mortality, and on the share which each may have had in causing death. By a wound being of itself *mortal*, we are to understand that it is capable of causing death directly or indirectly, in spite of the best medical assistance. It is presumed that the body is healthy, and that no cause has intervened to bring about, or even accelerate, a fatal result. The circumstance of a person labouring under disease when wounded in a vital part, will not, of course, throw any doubt upon the fact of such a wound being necessarily mortal, and of its having caused death. If there should be more wounds than one, it is easy to say, from the nature of the parts involved, which was likely to have led to a fatal result. In order to determine, on medical grounds, whether a wound was or was not mortal, we may propose to ourselves this question—Would the deceased have been likely to die at the same time, and under the same circumstances, had he not received the wound? There can obviously be no general rule for determining the mortal nature of wounds. Each case must be judged by the circumstances which attend it.

In some Continental states, the law requires that a medical witness should draw a distinction between a wound which is *absolutely* and one which is *conditionally* mortal. An absolutely mortal wound is defined to be that in which, the best medical assistance being at hand, being sent for, or actually rendered, the fatal event could not be averted. Wounds of the heart, aorta, and internal carotid arteries, are of this nature. A conditionally mortal wound is one in which, had medical assistance been at hand, been sent for, or timely rendered, the patient would, in all probability, have recovered. Wounds of the brachial, radial, and ulnar arteries may be taken as instances. The responsibility of an assailant is made to vary according to the class of injuries to which the wound may be referred by the medical witnesses; and, as it is easy to suppose, there is seldom any agreement on this subject. Our criminal law is entirely free from such subtleties. The *effect* of the wound, and the *intent* with which it was inflicted, are looked to; its anatomical relations, which must depend on pure accident, are never interpreted in a prisoner's favour. Some extenuation may, perhaps, be occasionally admitted when a wound proves mortal through an indirect cause, as inflammation or fever, and medical advice was obtainable, but not obtained until every hope of recovery had disappeared. It appears, however, from the case of *Reg.* v. *Thomas* and others (Gloucester Aut. Ass., 1841), that the mere neglect to call in medical assistance is not allowed in law to be a mitigatory circumstance in the event of death ensuing. The deceased died from the effects of a severe injury to the head, inflicted by the prisoners, but had had no medical assistance. The judge said it was possible that 'if he had had medical advice, he might not have died; but whoever did a wrongful act must take the whole consequences of it. It never could make any difference whether the party injured had or had not the means or the mind to apply for medical advice.' The prisoners were convicted. According to Lord Hale, if a man be wounded, and the wound, although not in itself mortal, turn to a gangrene or fever for want of proper applications, or from neglect, and the man die of gangrene or fever, this is homicide in the aggressor; for though the fever or gangrene be the immediate cause of death, yet the wound, being the cause of the gangrene or fever, is held the cause of death. These nice questions relative to the shades of responsibility for personal injuries, occasionally arise in cases in which persons have been wounded at sea on board of a ship in which there was no surgeon.

CHAPTER 29.

DEATH OF WOUNDED PERSONS FROM NATURAL CAUSES.—DISTINCTION BETWEEN REAL AND APPARENT CAUSE.—DEATH FROM WOUNDS OR LATENT DISEASE. —ACCELERATING CAUSE.—DEATH FROM WOUNDS AFTER LONG PERIODS.— AVOIDABLE CAUSES OF DEATH. — NEGLECT. — IMPRUDENCE. — UNSKILFUL TREATMENT.—UNHEALTHY STATE OF BODY.

Death of Wounded Persons from Natural Causes.—It is by no means unusual for individuals who have received a wound, or sustained some personal injury, to die from latent natural causes; and as, in the minds of non-professional persons, death may appear to be a direct result of the injury, the case can only be cleared up by the assistance of a medical practitioner. Such a coincidence has been witnessed in many instances of attempted suicide. A man has inflicted a severe wound on himself while labouring under disease; or some morbid change tending to destroy life has occurred subsequently to the infliction of a wound, and death has followed. Without a careful examination of the body, it is impossible to refer death to the real cause. The importance of an accurate discrimination in a case in which wounds or personal injuries have been caused by another, must be obvious on the least reflection. A hasty opinion may involve the accused in a charge of manslaughter; and although counsel might be able to show on the trial that death was probably attributable, not to the wound, but to the coexisting disease, yet it must be remembered that the evidence of a surgeon before a coroner or magistrate, in remote parts of this country, may be the means of causing the person charged to be imprisoned for some months previously to the trial. This is in itself a punishment, independently of the loss of character to which he must be in the mean time exposed.

Death from Wounds or Latent Disease.—A natural cause of death may be lurking within the body at the time that a wound is criminally inflicted, and a close attention to the symptoms preceding, and the appearances after death, can alone enable a surgeon to distinguish the real cause. A man may be severely wounded, and yet death may take place from rupture of the heart, the bursting of an aneurism, from apoplexy, phthisis, or other morbid causes which it is here unnecessary to specify. ('Cormack's Ed. Jour.,' 1846, p. 343.) If death can be clearly traced by an experienced surgeon to any of these diseases, the assailant cannot be charged with manslaughter; for the medical witness may give his opinion that death would have taken place about the same time and under the same circumstances whether the wound had been inflicted or not.

On these occasions one of the following questions may arise—Was the death of the person accelerated by the wound; or was the disease under which he was labouring so aggravated by the wound, as to produce a more speedily fatal termination? The answer to either of these questions must depend on the circumstances of each case, and the witness's ability to draw a proper conclusion from these circumstances. The maliciously accelerating of the death of another already labouring under disease, is criminal; for in a legal sense that which accelerates, causes. In *Reg.* v. *Timms* (Oxford Lent Ass., 1870), it was proved that the prisoner had struck the deceased some blows on the head with a hatchet. In twelve days, under treatment, he had partly recovered from the effects; but in six weeks afterwards he was seized with inflammation of the brain, with convulsions, and died. On inspection, disease of the kidneys was found, of which there had been no symptoms. Death was referred to this disease and to inflammation of the brain as the result of the blows. The judge directed the jury that if they believed the blows conduced in part to the death of the deceased, it was manslaughter, notwithstanding that other causes had combined with the blows to account for death. The prisoner was convicted. But there may be no connection between the violence and the disease causing death. In this case a charge of murder falls to the ground. A case of this kind was recently tried. (*Reg.* v. *Saxon*, Lancashire Sum. Ass., 1884.) A man struck his father a blow upon the back of the head with a hammer, inflicting a scalp-wound, with no signs of injury to the brain itself. The avowed object was to kill the father. As the injury was apparently not serious, the assailant was summarily sentenced by a magistrate to two months' imprisonment, a punishment which the father—a drunkard—thought inadequate. Hereupon the father became greatly excited—hemiplegic six days after the infliction of the wound—and died three days later. On post-mortem examination, the occipital bone was found indented at the seat of the blow, and there was a depressed fracture of the inner table of the skull at the point corresponding to the external injury. There was no effusion of blood on the surface of the brain in the neighbourhood of the injury, but a large clot was found in the lateral ventricle. Under these circumstances, two medical men very properly gave it as their opinion that the immediate cause of death was apoplexy, the clot being in the usual position in such cases, and that there was nothing in the history of the case, or in the appearances after death, that would justify them in stating that the effusion of blood, or, in other words, the man's death, was caused by the injury; and, in spite of the remarks of the judge, the prisoner was acquitted. ('Med. Chron.,' vol. i. p. 118.) In *Reg.* v. *Thompson* (Liverpool Sum. Ass., 1876), involving a charge of murder, it was proved that the prisoner had stabbed his wife in the cheek, producing a severe but not a mortal wound. This was on April 1st. The deceased was taken to an infirmary, and was there delivered of a child on the 3rd. She was attacked with puerperal fever and died on the 12th. It was properly stated by the medical witness that there was no necessary connection between the wound and the fever. The prisoner was acquitted on the charge of murder, and his life was saved. He was found guilty of wounding with intent to murder. In another case, *Reg.* v. *Hodgson* (Leeds Sum. Ass., 1876), the prisoner was charged with the manslaughter of his wife by striking her with a belt. A short time after the blow, she fell back and died suddenly. The proximate cause of death was proved to be heart-disease, the violence not being sufficient to account for it. The prisoner was acquitted. In 1873, an inquest was held at Haslar Hospital on the body of one *Rollings*. The deceased was struck by a seaman and fell with his right arm under him, breaking the two bones of his forearm just above the wrist. He died rather suddenly soon after the violence, and as this did not seem adequate to account for death, a careful inspection was made, and it was then found that death had resulted from disease of the heart.

Lord Hale, in remarking upon the necessity of proving that the *act* of a prisoner caused the death of a person, says, 'It is necessary that the death should have been occasioned by some corporeal injury done to the party by force, or by poison, or by some mechanical means which occasioned death; for although a person may, *in foro conscientiæ*, be as guilty of murder by working on the passions or fears of another, and as certainly occasion death by such means, as if he had used a sword or pistol for the purpose, he is not the object of temporal punishment.' Several acquittals have taken place of late years in cases in which the deaths of persons have been occasioned by terror, or dread of impending danger produced by acts of violence on the part of the prisoners, not, however, giving rise to bodily injury in the deceased. Under the 14 & 15 Vict., c. 100, the necessity for tracing death to some *corporeal* injury appears to be practically abolished. According to sec. 4, in any future indictment for murder or manslaughter it shall not be necessary to set forth the *manner* or the *means* by which the death of the deceased was caused. This question arose in *Reg.* v. *Heany* (Gloucester Lent Ass., 1875). The prisoner was charged with the manslaughter of his wife. She was suffering from cancerous disease. In the course of an altercation, the prisoner held up a knife in a threatening manner, but without touching her. This produced a shock, and she died two days after, from fright. The prisoner was acquitted, as there was no distinct proof of the acceleration of death by his act. He was convicted of an assault.

Which of Two Wounds caused Death?—A man may receive *two wounds* on provocation, at different times and from different persons, and die after receiving the second: in such a case, the course of justice may require that a medical witness should state which wound was the cause of death. A man receives during a quarrel a gunshot-wound in the shoulder. He is going on well, with a prospect of recovery, when in another quarrel he receives a severe penetrating wound in the chest or abdomen from another person, and, after lingering under the effects of these wounds for a longer or shorter period, he dies. If the gunshot-wound was clearly shown to have been the cause of death, the second prisoner could not be convicted of manslaughter; or if the stab was evidently the cause of death, the first prisoner would be acquitted on a similar charge. It might be possible for a surgeon to decide the question summarily, when, for instance, death speedily followed the second wound; and, on inspection of the body, the heart or a large vessel is discovered to have been penetrated; or, on the other hand, extensive sloughing, sufficient to account for death, might take place from the gunshot-wound, and, on inspection, the stab might be found to be of a slight nature, not involving any vital parts. In either of these cases, all would depend upon the knowledge, skill, and judgment of the medical practitioner; his evidence would be so important that no correct decision could be arrived at without it; he would be, in fact, called upon substantially to distinguish the guilty from the innocent. In *Reg.* v. *Foreman* (C. C. C., Feb. 1873), this question arose. The prisoner, it was proved, had struck the deceased some severe blows on the head. A fortnight afterwards the deceased, who had partially recovered, had a fight with another man, during which he received severe blows on his head. In another fortnight he had paralysis on the left side, and died in an hospital a few days afterwards. On inspection, a large abscess in the brain was found, which was the cause of the symptoms and death. The question was whether this abscess had arisen from the blows given by the prisoner, or from the violence sustained a fortnight afterwards. On this point there was no satisfactory medical evidence, and as the deceased had had no serious symptoms for a fortnight after the assault by the prisoner—in fact not until after the second fight—the jury acquitted him.

On some occasions death may appear to be equally a consequence of either or both of the wounds; in which case probably both parties would be liable to a charge of manslaughter. (See ‘Ann. d’Hyg.,’ 1835, t. 2, p. 432.) The second wound, which is here supposed to have been the act of another, may be inflicted by a wounded person on himself, in an attempt at suicide, or it may have an accidental origin. The witness would then have to determine whether the wounded person died from the wound inflicted by himself or from that which he had previously received. In the *Walworth murder*, which occurred in 1883, a grocer’s assistant pursued a man who had stolen a parcel from a cart, and the thief took refuge in a coal-shed, followed by the assistant. The latter was stabbed by the former twice in the abdomen on the right and left of the navel. The larger wound on the left suppurated, whilst the smaller wound on the right healed at once. The man died of peritonitis. On post-mortem examination, the editor found that the suppurating wound, which had been supposed to be the fatal one, did not involve a vital part; but that the small wound on the right, made by a knife, passed upwards and backwards, transfixing the liver, and puncturing the gall-bladder. The peritonitis was consequent on the escape of bile into the abdominal cavity. There was reason to believe that the non-fatal stab was first inflicted purposely, and the second and fatal wound might possibly have been caused by the deceased rushing upon the knife, held as it were in self-defence by the thief, who has never been discovered. It is not difficult to conceive what complications might arise in a trial for murder under such circumstances.

It may happen that the wounded person has taken *poison,* and has actually died from its effects, and not from the injuries or maltreatment. Again, a wounded person may have been the subject of subsequent ill treatment, and the question will arise—to which of the two causes his death was really due. It is to be observed of these cases that the supervening disease, the poison, or the subsequent ill treatment, should be of such a nature as to account for *sudden or rapid death;* since it would be no answer to a charge of death from violence to say that there were marks of chronic disease in the body, unless it was of such a nature as to account for the sudden destruction of life under the symptoms which actually preceded death. In the medical jurisprudence of wounds, there is probably no question which so frequently presents itself as this: it is admitted that the violence was inflicted, but it is asserted that death was due to some other cause, and the onus of proof lies on the medical evidence. Among numerous cases which occurred in England during a period of twenty years, the author found that the latent causes of death as registered in wounded persons have been chiefly inflammation of the thoracic or abdominal viscera, apoplexy, diseases of the heart and large blood-vessels, phthisis, ruptures of the stomach and bowels from disease, internal strangulation, and the rupture of deep-seated abscesses. In some of these cases the person was in a good state of health up to the time of the violence, and in others there was merely a slight indisposition. The history was nearly the same in all: it was only by careful conduct on the part of the medical witnesses that the true cause of death was ascertained. It is obvious that questions of malapraxis and life insurance, giving rise to civil actions, may have a close relation to this subject.

Death following Slight Personal Injuries.—An imputation has occasionally been thrown on the master of a school, when a boy has died soon after he has been punished in an ordinary way, and when there has been no suggestion that an undue amount of violence was used. In such cases there has been commonly some unhealthy state of the body to explain the fatal result. When the disease that gives rise to doubt is seated in a part, remote from that which sustained the violence, all that is required is that the examination of the body should be conducted with ordinary care. If the disease should happen to be in the part injured (the head or chest), the case is more perplexing. The difficulty can then be removed only by attentively considering the usual consequences of such injuries. The violence may have been too slight to account for the diseased appearance; and the disease itself, although situated in the part injured, may be regarded as an unusual consequence of such an injury. On the other hand, the presence of chronic disease will form no exculpation of acts of violence of this nature. In *Reg.* v. *Hopley* (Lewes Aut. Ass., 1860), there was chronic disease of long standing in the brain of the deceased boy, but it was proved that he was quite well and suffered from no unusual symptoms up to the time that a violent flogging was inflicted, and that this was followed by death in less than three hours from the commencement of the violence. It was not here a question even of acceleration, for the deceased might have lived for years in spite of the existence of this chronic disease. In some cases *slight blows* have been followed by fatal consequences, even when no disease existed to account for the result. Annan describes a case in which a healthy girl of four received a slight blow on the shin, about three inches below the knee, from the shaft of a wheelbarrow. There was pain, but no external mark of violence. The injury was considered to be so slight as to require no special treatment. On the following day there was increased pain. Severe constitutional symptoms set in, and the child died on the fourth day. ('Med. Times,' Aug. 1854.)

Death from Wounds after long periods.—Certain kinds of injuries are not immediately followed by serious consequences; but a wounded person may die after a longer or shorter period of time, and his death may be as much a consequence of the injury as if it had taken place on the spot. The aggressor, however, is just as responsible as if the deceased had been directly killed by his violence, provided the fatal result can be traced to the usual and probable consequences of the injury. Wounds of the head are especially liable to cause death insidiously—the wounded person may in the first instance recover—he may appear to be going on well, when, without any obvious cause, he suddenly expires. It is scarcely necessary to observe that, in general, an examination of the body will suffice to determine whether death is to be ascribed to the wound or not. In severe injuries affecting the spinal marrow, death is not an immediate consequence, unless that part of the organ which is above the origin of the phrenic nerves (supplying the diaphragm) is wounded. Injuries affecting the lower portion of the spinal column do not commonly prove fatal until after some days or weeks; but the symptoms manifested by the patient during life, as well as the appearances observed in the body after death, will sufficiently connect the injury with that event. Death may follow a wound, and be a consequence of that wound, at almost any period after its infliction. It is necessary, however, in order to maintain a charge of homicide, that death should be strictly and clearly traceable to the injury, and not be dependent on any other cause. A doubt on this point must, of course, lead to an acquittal of the accused.

Many cases might be quoted in illustration of the length of time which may elapse before death takes place from certain kinds of injuries, the injured person having ultimately fallen a victim to their indirect consequences. A case is related by Astley Cooper, of a gentleman who died from the effects of an injury to the head received about *two years* previously. The connection of death with the wound was clearly made out by the continuance of the symptoms of cerebral disturbance during the long period which he survived. Another case is mentioned by Hoffbauer, in which a person died from the effects of concussion of the brain as the result of an injury received eleven years before. ('Ueber die Kopfverletzungen,' 1842, p. 57.)

There is a rule in our law relative to the period at which a person dies from a wound—namely, that the assailant shall not be adjudged guilty of murder, unless death takes place *within a year and a day* after the infliction of the wound. To make the killing murder, the death must follow within a year and a day after the stroke or other cause of it. In practice, the existence of this rule is of little importance, but in principle it is erroneous. Most wounds leading to death generally destroy life within two or three months after their infliction; sometimes the person does not die for five or six months, and, in more rare instances, death does not ensue until after the lapse of twelve months, or even several years. These protracted cases occur especially in respect to injuries of the head and chest. In *Reg.* v. *Creuse* (Shrewsbury Sum. Ass., 1873), the prisoner was charged with the murder of a policeman (Lloyd), by knocking him down and kicking him on the chest and abdomen, on June 20th, 1872. Lloyd appeared to be much exhausted, but at first no serious injury was apprehended. The assailant was brought before the magistrates, and imprisoned for the assault. The day after the assault, Lloyd began to spit blood, but he continued to do duty until July 9th following. He then got gradually worse, and died on June 8th, 1873, from the effects of the violence inflicted on him nearly a year previously. Had the deceased lived thirteen days longer, the prisoner could not have been indicted for murder, as a year and a day would have elapsed after the stroke causing death. As it was, the jury found the prisoner guilty of manslaughter.

Secondary Causes of Death.—A person who recovers from the immediate effects of a wound may die from fever, inflammation or its consequences, pyæmia, erysipelas, delirium tremens, tetanus, or gangrene; or from an operation required during the treatment of a wound may prove fatal. These are what may be called secondary causes of death, or secondary fatal consequences of a wound. The power of deciding on the responsibility of an accused person for an event which depends only in an indirect manner on an injury originally inflicted by him, rests, of course, with the authorities of the law. But it is impossible that they can decide so difficult and nice a question in the absence of satisfactory medical evidence; and, on the other hand, it is right that a medical witness should understand the importance of the duty here required of him. *Pyæmia* or *erysipelas* may follow many kinds of serious wounds, and in some few instances be distinctly traceable to them; but, in others, the constitution of a person may be so broken up by dissipated habits as to render a wound fatal which in a healthy subject might have run through its course mildly, and have healed. When the pyæmia or erysipelas can be traced to a wound, and there is no other apparent cause of aggravation to which either of these disordered states of the body can be attributed, they can scarcely be regarded by a medical practitioner as unexpected and unusual consequences, especially when the injury is extensive, and seated in certain parts of the body, as in the scalp. If death take place under these circumstances, the prisoner will be held as much responsible for the result as if the wound had proved directly mortal. This principle has been frequently admitted by our law, and, indeed, were it otherwise, many reckless offenders would escape, and many lives would be sacrificed with impunity. It is, however, difficult to lay down general rules upon a subject which is liable to vary in its relations in every case; but when a wound is not serious, and the secondary cause of death is evidently due to constitutional peculiarities from acquired habits of dissipation, the ends of justice are probably fully answered by an acquittal; in fact, such cases do not often pass beyond a coroner's inquest.

The secondary causes of death may be arranged under the following heads :—

1. *The cause is unavoidable.*—Of this kind are tetanus, following laceration of tendinous and nervous structures; erysipelas, following lacerated wounds of the scalp ; peritoneal inflammation, following blows on the abdomen with or without rupture of the bladder or intestines, and effusion of their contents; strangulation of the intestines (phrenic hernia), following rupture of the diaphragm; and others of a like nature. Here, supposing proper medical treatment and regimen to have been pursued, the secondary cause of death was unavoidable, and the fatal result certain.

2. *The cause avoidable by good medical treatment.*—There are, it is obvious, many kinds of wounds which, if properly treated in the first instance, may be healed and the patient recover, but when improperly treated they prove fatal. In the latter case it will be a question for a witness to determine how far the treatment aggravated the effects of the violence, and, from his answer to this, the jury may have to decide on the degree of criminality which attaches to the accused. Let us suppose, for instance, that an ignorant person has removed a clot of blood, which sealed up the extremity of a blood-vessel, in consequence of which fatal bleeding has ensued, or that he has caused death by unnecessarily interfering with a penetrating wound of the chest or abdomen : it would scarcely be just to hold the aggressor responsible, since, but for the gross ignorance and unskilfulness of his attendant, the wounded person might have recovered from the effects of the wound. When death is really traceable to the negligence or unskilfulness of a surgeon who is called to attend on a wounded person, this circumstance ought to be, and commonly is, admitted in mitigation, supposing that the wound was not originally of a mortal nature. Lord Hale observes, 'It is sufficient to constitute murder, that the party dies of the wound given by the prisoner, although the wound was not originally mortal, but became so in consequence of negligence or unskilful treatment; but it is otherwise where death arises, not from the wound, but from unskilful applications or opera-

tions used for the purpose of curing it.' The medical jurist will perceive that a very nice distinction is here drawn by this great judge between death as it results from a wound rendered mortal by improper treatment, and death as its results from improper treatment irrespective of the wound. In the majority of cases such a distinction could scarcely be established, except upon speculative grounds, and in no case, probably, would there be any accordance in the opinions of medical witnesses. In slight and unimportant wounds, it might not be difficult to distinguish the effects resulting from bad treatment from those connected with the wound, but there can be few cases of severe injury to the person, wherein a distinction of this nature could be safely made; and the probability is that no conviction for murder would now take place if the medical evidence showed that the injury was not originally mortal, but only became so by unskilful or improper treatment. In such a case, it would be impossible to ascribe death to the wound, or to its usual or probable consequences; and without this it is not easy to perceive on what principle an aggressor could be made responsible for the result.

3. *Comparative skill in treatment.*—If death has been caused by a wound, the responsibility of an aggressor is not altered by the allegation that, under more favourable circumstances and with *more skilful treatment*, a fatal result might have been averted. At the same time, it is obvious that a serious responsibility is thrown on practitioners who undertake the management of cases of criminal wounding. Any deviation from ordinary practice should therefore be made with the greatest caution, since novelties in practice will, in the event of a fatal result, form one of the best grounds of defence in the hands of a prisoner's counsel. On these occasions every point connected with the surgical treatment will be the subject of rigorous inquiry and adverse professional criticism. In the case of a severe lacerated wound in the hand or foot, followed by fatal tetanus, it may be said that the wounded person would not have died had amputation been at once performed. In this instance, however, a practitioner may justify himself by showing, either that the injury was too slight to require amputation, or that the health or other circumstances connected with the deceased would not allow of its being performed with any reasonable hope of success. On the other hand, if the practitioner performed amputation, and the patient died, then it would be urged that the operation was premature, or wholly unjustifiable, and that it had caused death. Here the surgeon is bound to show that the operation was necessary according to the ordinary rules of practice. The treatment of severe incised wounds of the throat, when the windpipe is involved, sometimes places a surgeon in an embarrassing position. If the wound is left open, death may take place from bleeding; if it be prematurely closed, blood may be effused into the windpipe and cause death by suffocation.

4. *The cause avoidable but for imprudence or neglect on the part of the wounded person.*—A man who has been severely wounded in a quarrel may obstinately refuse medical assistance, or he may insist upon taking exercise, or using an improper diet, contrary to the advice

of his medical attendant; or by other imprudent practices, he may thwart the best-conceived plans for his recovery. Let us take a common case as an illustration. A man receives a blow on the head in a pugilistic combat, from the first effects of which he recovers, but, after having received surgical assistance, he indulges in excessive drinking, and dies. The aggressor is tried on a charge of manslaughter, and found guilty. Death under these circumstances is commonly attributed by the medical witness to effusion of blood on the brain; but it cannot be denied that the excitement produced by intoxicating liquors will sometimes satisfactorily account for the fatal symptoms. (See *Reg.* v. *Saxon*, p. 292, *ante.*) In the case which we are here supposing, such an admission might be made, and the prisoner receive the benefit of it; for the imprudence or negligence of a wounded person ought not, morally speaking, to be considered as adding weight to the offence of the aggressor. If the symptoms were from the first unfavourable, or the wound likely to prove mortal, circumstances of this kind could not be received in mitigation. Our judges have shown themselves at all times unwilling to admit them. The legal responsibility of the assailant is the same, whether the deceased died on the spot, or some days, weeks, or months afterwards, unless it can be distinctly proved that his death was immediately connected with the imprudence or excess of which he was guilty, and wholly independent of the wound. But, although a prisoner should be found guilty of manslaughter under these circumstances, the punishment is so adjusted by our law as to leave a considerable discretionary power in the hands of a judge. This is, indeed, tantamount to a direct legal provision, comprehending each different shade of guilt; a man is held responsible for a wound rendered accidentally mortal by events over which he could have had no control, but which in themselves ought to be regarded as in some degree exculpatory. The punishment attached to his offence may be severe or slight, according to the representation made by a medical witness of the circumstances which rendered the wound mortal; if he neglect to state the full influence of imprudence or excess on the part of the wounded person, where either has existed, over the progress of the wound, he may cause the prisoner to be punished with undue severity. The humanity of our judges is such that, when medical evidence is clear and consistent on a point of this nature, and there are no circumstances in aggravation, they commonly pass a mild sentence. (See case 'Ann. d'Hyg.,' 1842, p. 128.) The neglect to call in a medical practitioner, or the refusal to receive medical advice, will not, however, according to the decision in *Reg.* v. *Thomas* (Gloucester Aut. Ass., 1841), be considered a mitigatory circumstance in favour of the prisoner, even although the wound was susceptible of being cured. A man may receive a lacerated wound of a limb, which is followed by tetanus or gangrene, and thus proves fatal; he may have declined receiving medical advice, or have obstinately refused amputation, although proposed by his medical attendant. This would not operate as a mitigatory circumstance on the part of an assailant, because a wounded person is not compelled to call for medical assistance, or to submit to an operation, while a medical witness could not always be in a condition to swear that the operation would have positively saved his life; he can merely state that it might have afforded him a better chance of recovery. Again, a person may receive a blow on the head producing fracture, with great depression of bone and symptoms of compression of the brain: a surgeon may propose the operation of trephining to elevate the depressed bone, but the friends of the wounded man may not permit the operation to be performed. In such a case, the line of duty of the witness will be to state the facts to the court, and it is probable that, in the event of conviction, there would be some mitigation of punishment; because such an injury, if left to itself, must in general prove mortal, and no doubt could exist in the mind of any surgeon as to the absolute necessity for the operation. But the neglect or improper conduct of a person who receives a wound thus rendered fatal does not exculpate the aggressor. The crime is either murder or manslaughter.

5. *The cause avoidable but for an abnormal or unhealthy state of the body of the wounded person.*—Wounds which are comparatively slight sometimes prove indirectly fatal, owing to the person being in an unhealthy condition at the time of their infliction. In bad constitutions, compound fractures or slight wounds, which in a healthy person would have a favourable termination, are followed by gangrene, pyæmia, or erysipelas, proving fatal. Here the responsibility of an assailant for the death may become reduced, so that, although found guilty of manslaughter, a mild punishment might be inflicted. The consequence may be, medically speaking, unusual or unexpected, and, but for circumstances wholly independent of the act of the accused, would not have been likely to destroy life. In general, in the absence of malice, this appears to be the point to which the law closely looks, in order to make out the responsibility of the accused—namely, that the fatal secondary cause must be something not unusual or unexpected as a consequence of the particular injury. The medico-legal question presents itself under this form — Would the same amount of injury have been likely to cause death in a person of ordinary health and vigour? A man otherwise healthy, labouring under rupture, may receive a blow on the groin, attended with laceration of the intestine, gangrene, and death; another with a calculus in the kidney may be struck in the loins and die, in consequence of the calculus perforating the blood-vessels and causing fatal bleeding or subsequent inflammation. In these cases the effects of the violence must be regarded as something unexpected: it would not have produced serious mischief in an ordinarily healthy person, and hence the responsibility of an assailant becomes much diminished. The crime is undoubtedly manslaughter, but the punishment may be of a lenient description. A defence of this kind will, however, be limited by circumstances. A case is reported, in which a *Dr. Fabricius* was tried at the Old Bailey for the murder of his servant by striking her a blow behind the ear whereby a large abscess, situated at that part, was ruptured, and this ultimately caused her death. The chief question on the trial was,

whether the deceased had died from the effects of the violence, or from the disease under which she was at that time labouring. The doctor ingeniously urged in his defence that he had struck the blow merely for the purpose of opening the abscess. The jury, however, did not agree in taking this professional view of the matter, and they found him guilty of manslaughter.

It must be evident that there exist numerous internal diseases, such as aneurism, and various morbid affections of the heart and brain, which are liable to be rendered fatal by *slight* external violence. The law, as applied to these cases, is thus stated by Lord Hale: 'It is sufficient to prove that the death of a person was accelerated by the malicious act of the prisoner, although the former laboured under a mortal disease at the time of the act.' In those cases in which a slight degree of violence has been followed by fatal consequences, it is for a jury to decide, under all the circumstances, upon the actual and specific intention of the prisoner at the time of the act which occasioned death. According to Starkie, 'it seems that in general, notwithstanding any facts which tend to excuse or alleviate the act of the prisoner, if it be proved that he was actuated by prepense and deliberate malice, and that the particular occasion and circumstances upon which he relies were sought for and taken advantage of merely with a view to qualify actual malice, in pursuance of a preconceived scheme of destruction, the offence will amount to murder.' In most of these cases there is an absence of intention to destroy life, but the nature of the wound, as well as the means by which it was inflicted, will often suffice to develop the intention of the prisoner. An accurate description of the injury, if slight, may afford strong evidence in favour of the accused, since the law does not so much regard the means used by him to perpetrate the violence, as the actual intention to kill, or to do great bodily harm. Serious injury, causing death by secondary consequences, will admit of no exculpation when an assailant was aware, or ought to have been aware, of the condition of the person whom he struck. Thus, if a person notoriously ill, or a woman while pregnant, be maltreated, and death ensue from a secondary cause, the assailant will be held responsible; because he ought to know that violence of any kind to persons so situated must be attended with dangerous consequences. So, if the person maltreated be an infant or a decrepit old man, or one labouring under a mortal disease, it is notorious that a comparatively slight degree of violence will destroy life in these cases, and the prisoner would properly be held responsible. A wound which *accelerates* death *causes* death, and may therefore render the aggressor responsible for murder or manslaughter, according to the circumstances. The Commissioners appointed to define the criminal law on the subject of homicide thus express themselves: 'Art. 3. It is homicide, although the effect of the injury *be merely to accelerate the death* of one labouring under some previous injury or infirmity, or although, if timely remedies or skilful treatment had been applied, death might have been prevented.' This is conformable to the decisions of our judges. According to Lord Hale, if a man has a disease which in all likelihood would terminate his life in a short time, and another gives him a wound or hurt which hastens his death, this is such a killing as constitutes murder.

6. *Abnormal Conditions.*—When an assailant could not have been aware of the existence of a diseased or abnormal condition of parts in the wounded person, the question is somewhat different. In many persons the skull is preternaturally thin, and in most persons it is so in those places corresponding to the Pacchionian bodies. In a case of this kind a moderate blow on the head might cause fracture, accompanied by effusion of blood, depression of bone, or subsequent inflammation of the brain and its membranes, any of which causes might prove fatal. In some persons, all the bones of the body are unusually *brittle*, so that they are fractured by the slightest force. Inflammation, gangrene, and death may follow, when no considerable violence has been used; but these being unexpected consequences, and depending on an abnormal condition of parts unknown to the prisoner, his responsibility may not, *cæteris paribus*, be so great as under other circumstances. This condition of the bones can be determined only by a medical practitioner. Facts of this kind show that the degree of violence used in an assault cannot always be measured by the effects, unless a careful examination of the injured part is previously made.

7. *Difficulty of proof in death from secondary causes.*—When a person is charged with having caused the death of another through violence terminating in some fatal disease, the case often admits of a skilful defence, and this in proportion to the length of time after the violence at which the deceased dies. This disease, it may be urged, is liable to appear in all persons, even the most healthy; or it may arise from causes unconnected with the violence. In admitting these points, it must be remembered that death may be proved to have been indirectly a consequence of the wound by the facts: (1) that the supervention of the secondary cause, although not a common event, lay in the natural course of things; (2) that there did not exist any accidental circumstances which were likely to have given rise to this secondary cause independently of the wound. The proof of the first point amounts to nothing, unless the evidence on the second point is conclusive.

CHAPTER 30.

WOUNDS INDIRECTLY FATAL.—TETANUS FOLLOWING WOUNDS.—ERYSIPELAS.—DELIRIUM TREMENS.—GANGRENE.—DEATH FROM SURGICAL OPERATIONS.—PRIMARY AND SECONDARY CAUSES OF DEATH.—UNSKILFULNESS IN OPERATIONS.—PYÆMIA.—MEDICAL RESPONSIBILITY IN REFERENCE TO OPERATIONS.—ACTIONS FOR MALAPRAXIS.

Tetanus following Wounds.—Tetanus frequently presents itself as a secondary fatal consequence of wounds, especially of those which are lacerated or contused, and affect nervous or tendinous structures. It has often occurred as a result of slight bruises or lacerations, when the injury was so slight as to excite no alarm; and it is a disease which gives no warning of its appearance. Tetanus may come on spontaneously, *i.e.* independently of the existence of any wound on the body. Cases have been brought into the London hospitals, in which the only cause of this disease appeared to be exposure to cold or wet, or, in some instances, exposure to a current of air. ('Lancet,' 1844, ii. p. 351.) It is scarcely possible to distinguish, by the symptoms, tetanus from wounds (traumatic) from that which occurs spontaneously as a result of natural causes (idiopathic). In endeavouring to connect its appearance with a particular wound or personal injury, it should be observed (1) whether there were any symptoms indicative of it before the maltreatment; (2) whether any probable cause could have intervened to produce it, between the time of its appearance and the time at which the violence was inflicted; (3) whether the deceased ever rallied from the effects of the violence. The time at which tetanus usually makes its appearance, when it is the result of a wound, is from the third to the sixth day; but it may not appear until three or four weeks after the injury, and the exciting cause may still be traced to the wound which may have healed. When resulting from a wound, it is generally fatal.

A medical practitioner is bound to exercise great caution before he pronounces an opinion that a fatal attack of tetanus has arisen either from spontaneous causes, or from slight blows or personal injuries. A rigorous inquiry should be made into all the attendant circumstances. Slight punctured wounds, operating as a course of tetanus, have been overlooked or only discovered by accident after death, and it is highly probable that many cases have been set down as idiopathic tetanus in which, by proper inquiry, the disease might have been traced to a wound or some personal injury. In one instance the tetanus was at first considered to be idiopathic; but shortly before death a small black mark was observed on the thumb-nail. On making inquiry, it was found that a few days previously to the attack a splinter of wood had accidentally penetrated the thumb. The patient attached so little importance to the accident that he did not mention the circumstance to his medical attendant. This was no doubt the cause of the disease. (For two similar cases, see 'Brit. Med. Jour.,' 1872, ii. p. 594.) Many trials for murder and manslaughter have occurred in this country in which tetanus was the immediate cause of death; and the defence has generally rested upon the probable origin of the disease from accidental causes.

Erysipelas, like tetanus, may be a fatal result of slight injuries. Wounds affecting the scalp are liable to be followed by this disease. Burns and scalds sometimes prove fatal through this secondary cause. Some persons are particularly prone to erysipelatous inflammation, and thus wounds comparatively slight may have a fatal termination. When a wounded person has died from this disease, an assailant cannot be made responsible for the fatal result, unless the erysipelas is clearly traced to the injury. The medical facts that the person assaulted has never recovered from the effects of the violence, and that the inflammation set up has suddenly assumed an erysipelatous character, are sufficient to establish this connection. If there has been recovery, and an interval of some days has elapsed, a doubt may arise respecting the connection of the erysipelas with the violence inflicted. This disease is occasionally idiopathic, *i.e.* it appears like tetanus without any assignable cause. In *Reg.* v. *Jones* (Monmouth Lent Ass., 1873), the prisoner, a collier, was convicted of manslaughter under the following circumstances: the prisoner was fighting with another man, and the deceased, a woman, endeavoured to part them. The prisoner fixed his teeth savagely on her thumb, and bit her severely. The wound was poulticed. It was not until the fourth day that she had medical advice. Erysipelas had then commenced, and had caused great swelling of the limb up to the shoulder. She died in three weeks. The medical evidence was to the effect that she had died of erysipelas from the wound, but the fatal result was in a great measure due to an impaired state of health from excessive drinking. The prisoner was, notwithstanding, found guilty.

It is sometimes difficult to establish the connection of erysipelas with a wound, especially when the disease occurs some time after its infliction, and in a remote part of the body not implicated in the wound. When this connection cannot be distinctly made out, there will be an acquittal.

Delirium tremens is a disease which frequently presents itself as a secondary consequence of injuries in persons of intemperate habits. Whether the injury be slight or severe, this disease may equally supervene and prove fatal. It is observed occasionally as a consequence of operations required for the treatment of wounded persons. The remarks made at p. 301 upon the influence of unhealthy constitutions on wounds, apply with especial force to cases of this description.

Death from Surgical Operations.—In the treatment of wounds, surgical operations are frequently resorted to, and a wounded person may die, either during the performance of an operation, or from its consequences. A question will thence arise, whether the person who inflicted the wound should be held responsible for the fatal result. The law regards a surgical operation as part of the treatment, and if undertaken *bonâ fide*, and performed with reasonable care and skill, the aggressor will be held responsible, whatever may be the result. The necessity for the operation, and the mode of performing it, will be left to the operator's judgment. As the defence may turn upon the operation having been performed unnecessarily, and in a bungling and unskilful manner, it will be right for a practitioner, if possible, to defer it until he has had the advice and assistance of other practitioners. According to Lord Hale, if death takes place from an *unskilful operation*, performed for the cure of a wound, and not from the wound, the responsibility of the prisoner ceases; but he does not appear to have considered that death may take place as a consequence of the most skilful operation required for the treatment of a wound, and yet be wholly independent of the wound itself.

If the operation has been performed by the medical witness himself, and the necessity for its performance is questioned by counsel for the prisoner, it is open to the witness to give the requisite explanation in his evidence. It would appear from a case tried before Shee, J., that the necessity for an operation will *not* be assumed; but if called in question, it must be proved by witnesses for the prosecution. In *Reg.* v. *Moreland* (C. C. C., Sept. 1865), the prisoner threw the deceased on the ground and fractured his leg. The limb was amputated, and the man subsequently died. Counsel for the prisoner asked the surgeon from the hospital, who spoke to the death of the deceased, whether an operation was really necessary. The witness said he could not tell, as he had not had charge of the case previous to the operation. Counsel then raised the question whether prisoner or the doctors had caused the man's death. The counsel for the prosecution suggested that the court might accept as a fact that amputation would not have been performed had it not been necessary; but the judge said that would not do. They must deal with the case on the evidence before them. He then observed to the jury that, although undoubtedly amputation would not be adopted at such a place as the London Hospital without the necessity for it, yet evidence to that effect must be before them on oath. They could not act on what they had every reason to believe; therefore they must acquit the prisoner. The failure of justice in this case rested with those who were concerned for the prosecution. The operator, who could probably have satisfied the court that he had not cut off the wrong leg, and that there were good reasons for performing the operation, was not called as a witness; but in his place a witness was summoned who could not answer these necessary questions.

Death is by no means an unusual result of severe operations, the secondary consequences under which the patient may die being very numerous even when the case is skilfully managed. Sometimes the patient will die on the table, although but little blood may have been lost. Fear, pain, and sudden shock to the nervous system have caused death under these circumstances. The most common indirect causes of death after severe operations are secondary hæmorrhage, erysipelas, tetanus, delirium tremens, pyæmia, and gangrene of the stump.

Should an operation be unnecessarily or unskilfully performed, the responsibility of an aggressor would, it is presumed, cease, if the death of a wounded person could be clearly traced to it. Thus if, in carelessly bleeding, the brachial artery should be laid open ('Ann. d'Hyg.,' 1834, t. 2, p. 445), or if, in performing amputation, a large artery be improperly secured, so that the patient in either case dies from loss of blood, the prisoner could not be equitably held responsible; because it would be punishing him for an event depending on the unskilfulness of a medical practitioner. According to Platt, B., a prisoner will be held responsible, if the original wound were likely to produce death, although unskilfully treated. Supposing the bleeding or amputation to be performed with ordinary care and skill, and yet, in the one case, inflammation of the veins, and in the other erysipelas, tetanus, gangrene, or fever should destroy life, the prisoner will be liable for the consequences. The practice of the law is strictly consistent with justice. Should the operation be considered to be *absolutely* required for the treatment of a wound, which, according to all probability, would prove mortal without it; should it be performed with ordinary skill, and still death ensue as a direct or indirect consequence,—it is only just that the person who inflicted the injury should be held responsible for the result. It is presumed in these cases that, were the patient left to himself, he would in all probability die from the effects of the wound. If, therefore, a surgeon, knowing that an operation would give a chance of saving life on such an occasion, did not perform it, it might be contended, in the defence, that the deceased had died, not from the wound, but from the incompetency and neglect of his medical attendant. Hence it follows that if, during this necessary treatment, unforeseen though not unusual causes cut life short, no exculpation should be admitted, if it went to attack the best-directed efforts made for the preservation of life. (See 'Ann. d'Hyg.,' 1835, t. 1, p. 231.) If an operation is rendered necessary by reason of the improper treatment of the wound, the responsibility of an assailant for a fatal result ceases.

In another part of this work (p. 31) we have referred to the case of *Kelly*, who was tried for the murder of Talbot. (*Reg.* v. *Kelly*, Dublin Commis. Court, Nov. 1871.) The facts of this case, although made a subject of the most violent contention in a medical, legal, and political view, were really of a very simple kind. On July 12, the deceased received a pistol-shot wound at the back of his neck, and died from the effects on July 16. The bullet fractured and splintered the atlas, wounding and crushing the soft parts of the neck, and leading to the formation of an abscess in this part. The actual cause of death was inflammation of the spinal cord and its membranes. Stokes, who attended the deceased, considered it necessary to enlarge the wound for the purpose of removing the bullet, which was then supposed to be lying within reach. In this operation a small artery (the occipital) was divided, but the quantity of blood lost was small; the bleeding was stopped by compression, and this bleeding had no influence in causing death. The defence was that the wound would not have proved fatal but for the bad surgical treatment; that the probing of the wound was unnecessary, and that it was unskilfully performed. There was the evidence of experts on both sides; but the facts proved, apart from the opinions expressed, could leave no reasonable doubt that Stokes had treated the case with *bona fides* and with competent skill. The prisoner was positively identified by the deceased and others, and yet upon this evidence the jury returned a verdict of not guilty. (See 'Brit. Med. Jour.,' 1871, ii. p. 716.)

The failure of justice in this case appears to have been chiefly owing to the fact that the jury were allowed to form their opinions on the surgical treatment pursued, whereas the rule of law is clear as to responsibility; and the only question which should have been submitted to them was, whether the prisoner was or was not the man who fired the pistol-shot. The English practice, as already quoted above, is that if a man unlawfully inflicts a dangerous wound on another, and the wounded person, after being treated by qualified practitioners acting with *bona fides*, and applying themselves with the best of their ability to the case, dies of the wound, the man inflicting it is really guilty of murder, even although an erroneous treatment of the case by the practitioner may have been the cause of death. In fact, under no other rule would a medical man be safe in dealing with a case of criminal wounding. If Kelly's case were taken as a precedent, no surgical treatment should be adopted under these circumstances. The wound should be allowed to take its mortal course.

Death from Anæsthetics in Surgical Operations.—In a large number of operations it is now the general practice among surgeons to administer *chloroform*, *ether*, or other anæsthetics, not only to allay pain, but to prevent that exhaustion to the patient which is likely to arise from protracted surgical proceedings. In spite of care on the part of the operator, these vapours are liable to destroy life in an unexpected manner, and the patient may die either before the operation is commenced or during its performance. The facts may leave no doubt that the wounded person died from the anæsthetic, and not from the wound or the operation. On inspection of the body, the heart may be found in an unhealthy state, a fact which is usually considered sufficient to account for the fatal effects of chloroform vapour. In a case of this kind, what becomes of the responsibility of the person who inflicted the original wound? No decision, so far as we know, has ever been given on this point. Was the use of chloroform vapour in a professional view a *necessary* part of the treatment? Was it skilfully and *properly* administered? Could the diseased condition of the heart which rendered the effects of the vapour more fatal than usual have been detected by the operator, so as to show the impropriety of administering it in this case? These questions should receive satisfactory answers before the aggressor is rendered responsible for death under such peculiar circumstances.

An action was brought against a medical man (*Absolom* v. *Statham*, Q. B., Nov. 1867) for forcibly administering chloroform to the plaintiff against her will, and extracting six of her teeth; also for careless and unskilful treatment, whereby her health was injured. The medical evidence showed that the woman had consented to the operation, and that it had been properly performed; also that her health had sustained no injury by the chloroform or the operation, and that most of her symptoms were due to hysteria. Cockburn, C.J., in summing up the case, said that the two charges or complaints were entirely distinct and different—one being for an assault, and the other for malpractice. The law was clear as to both. No surgeon had a right to perform any operation against the will of the patient, *so long as the patient preserved consciousness and will*; and if, therefore, the jury believed the plaintiff's story, then she was entitled to a verdict, although the amount of the damages would depend upon their impression as to the extent of the injury. Then as to the other ground of complaint, the law was equally clear, that every medical practitioner was bound to bring a reasonable amount of skill and care to the performance of the duty he undertook. The jury found for the defendant on both grounds. This shows the state of the law in reference to the responsibility of medical men who undertake operations under anæsthetics.

But there is another form in which a question of medical responsibility may present itself. This is illustrated in the case of *Lamb* v. *Barton and Bennett* (Wicklow Sum. Ass., 1873). This was an action by a widow to recover damages for the death of her husband under chloroform by reason of the negligence and unskilfulness of the defendants' surgeons, in administering it. Amputation was rendered necessary by an accident; chloroform was administered; the man died in five minutes, before the operation could be performed. The proof of negligence failed, and a verdict was returned for the defendants. ('Brit. Med. Jour.,' 1873, ii. p. 92.)

By an operation being *absolutely required*, are we to understand that it is necessary to preserve life, *i.e.* that the wound will probably prove fatal without it? Bleeding and cupping may, very occasionally, be necessary as part of the treatment of a wounded person; but unless it could be sworn that this treatment was required, in the judgment of the surgeon, for the *preservation of life* from the injury inflicted, it is doubtful whether, in the event of death occurring from these simple operations, the assailant would be held responsible for the fatal result. From cases hitherto decided, it would appear that the law regards three circumstances in death following surgical operations: first, the necessity of the operation itself; second, the competency of the operator; and third, whether the wound would be likely to prove mortal without it.

Operations under a Mistaken Opinion.—It may happen that the wound is not of a mortal nature, and that, although an operation was skilfully performed, it was *not* necessary to save life; in other words, the wounded person may die from the immediate results of a serious operation, performed under a mistaken view of the case. It is well known to surgeons that a cancerous tumour has been occasionally mistaken for aneurism, an artery has been secured, and death has followed. A case occurred in which the carotid artery was tied; and another in which the operation was performed on the common iliac artery for supposed aneurisms: in both of these instances the patients sank, and after death the tumours were proved not to have been aneurismal. The operations were not necessary, they proved fatal, and they had been performed under a mistake. In a case reported by Syme, the carotid artery was tied, and the patient died in a few days from loss of blood. After death it was found that the tumour was not an aneurism, but a cyst. ('Dub. Med. Press,' 1847, p. 302.)

Let us assume that a man labouring under a slight aneurism of a large artery receives a blow on the part, the tumour gradually increases, and is mistaken for an abscess by three or four surgeons, whose professional standing would prevent their general competency from being questioned. Under a wrong diagnosis, it is opened, and the patient dies on the spot. In such a case it would be unjust to make the aggressor liable; for, even admitting that the aneurism had resulted from the blow, and that a competent surgeon acted with *bona fides*, the treatment would be unskilful, and the case would fall under the rule laid down by Lord Hale (*ante*, p. 298). The real facts, however, may not transpire until after the death of the wounded person; and it may then be alleged by a prisoner's counsel that the operation was not necessary to save life, and that the wounded man might have recovered without it. From the ruling of our judges on various occasions in which this question has arisen, it would appear that the relative degree of skill possessed by medical men is not a question for a jury in a criminal case; although in a civil case, as in an action for malapraxis, the whole of the medical facts are invariably submitted to their judgment. This difference can only be justified by the assumption that a man who inflicts a wound must take all the consequences—good or bad. No operation would have been required but for the injury, and the prisoner ought not to escape on account of want of skill in a surgeon, or of a mistake made by a skilful operator. It was decided in the cases of *Rex* v. *Quain* and *Reg*. v. *Pym*, that, although the indictment alleged that the deceased died of the wound, while in fact he died from the results of an operation, yet it was good in point of law.

When a wounded person is taken to an hospital in which gangrene or erysipelas is spreading, and he is attacked by one of these diseases, before or after the performance of an operation, and dies, a prisoner may be held responsible for the fatal result. It might be contended that the transportation of the wounded man to such a locality was not absolutely necessary for his treatment, or for the preservation of his life, and that he would not have died but for the accidental presence of an infectious disease. Cases of this kind cannot easily be determined by any general rules.

Pyœmia.—In addition to erysipelas and tetanus, there is another cause of death which is liable to follow personal injuries and operations, namely *pyœmia,* or the introduction of pus into the blood by absorption or by the mouths of divided blood-vessels. The purulent matter acts as a poison. According to Wilks's observations, pyæmia is seldom observed after superficial injuries during the process of healing, or after wounds resulting from simple operations; but it occurs frequently when a bone is involved, either from the injury or as the result of an operation. Inflammation of the cellular membrane surrounding bone is a condition highly favourable to its occurrence. The medical witness must remember that pyæmia, like tetanus and erysipelas, may arise from causes totally irrespective of wounds or personal injuries. ('Guy's Hosp. Rep.,' 1859, p. 179.)

The modern antiseptic treatment of wounds has greatly reduced the risk of purulent infection and blood-poisoning; and it is not improbable that the omission to employ antiseptic treatment in cases of wounding may hereafter be largely made use of for the purposes of defence.

Questions relative to responsibility in death following operations would come more frequently before courts of law, were it not that the cases are stopped in the coroners' courts by verdicts of accidental death. (Lond. 'Med. Gaz.,' vol. 19, p. 157.) It unfortunately happens that on these occasions there is a great difference of opinion among medical witnesses respecting the connection of the disease with the death, and indeed the necessity for the operation itself. The evidence of opinion in favour of the prosecution is sometimes balanced by that urged in the defence, and, under these circumstances, the only course open to the court is to direct an acquittal. Differences of opinion upon these subjects among members of the profession tend to convey to the public the impression that there are no fixed principles upon which medical opinions are based, and, consequently, that it would be dangerous to act upon them. Thus it is that we are accustomed to hear of a medical prosecution and a medical defence, as if the whole duty of a medical jurist consisted in his making the best of a case on the side for which he happens to be engaged—adopting the legal rule for suppressing those points which are against him, and giving an undue prominence to others which may be in his favour. This is an unfortunate condition of things, for which at present there appears to be no adequate remedy.

Medical Responsibility for Operations. Malapraxis.—This is a very wide subject, but it can here be only glanced at in a few of its leading features. It was held by Lord Ellenborough that, if a person acting in a medical capacity be guilty of misconduct, arising either from gross ignorance or criminal inattention, by which a patient dies, he is guilty of manslaughter. Faults—such as omissions, or errors in judgment, to which all are liable—are not visited with this amount of criminality. The same rule applies to the licensed as to the unlicensed practitioner; but it would appear, from the charge of Williams, J. (Winchester Spring Ass., 1847), that a degree of unskilfulness which might lead to the conviction of a licensed, would justify the acquittal of an unlicensed person. This was in the case of a midwife alleged to have caused the death of a woman on whom she had been called to attend. 'The charge,' said the judge, 'appeared to be that by want of skill or attention to her duties, she had caused the death of the woman upon whom she was attending. In order to constitute this offence, it must be shown that the party was guilty of criminal misconduct, either arising from gross ignorance or want of skill, or gross inattention. With respect to the degree of want of skill, he must say that it was not to be expected that a midwife, who was called in to attend a person in the humble class of the deceased, a soldier's wife, should exhibit what a regular medical practitioner would call competent skill. It was enough if she applied that humble skill which, in ordinary cases, would lead to a safe delivery. She was *not* bound to have skill sufficient to meet peculiar and extraordinary exigencies, although in the case of a regular medical man such skill might be required. The class of this humble practitioner was absolutely necessary for the poorer classes, and, although on the one hand it was fit the law should protect a patient by punishing a person for gross want of skill, yet he thought there would be much to be lamented if it was applied with such severity as to render a party not possessing skill of this kind liable to punishment for manslaughter.' These observations would scarcely be strictly applicable in the present day, when certified midwives are generally available, at all events in our large towns.

Charges of manslaughter have frequently been brought against medical practitioners in cases of midwifery. In some instances gross mismanagement has been proved; the womb, and even parts of the viscera, have been torn away, and in such cases convictions have very properly followed. It is well known, however, that much difference of opinion exists among the most eminent practitioners of midwifery respecting the treatment to be pursued in certain cases of difficulty, as where the afterbirth presents (placenta prævia). There are eminent accoucheurs who advise in this case entirely opposite modes of practice, and who look upon that pursued by the other as of the most dangerous kind. When death is really not a result of the medical treatment, an action for damages may be brought against the practitioner on a charge of *malapraxis.*

It has been a question whether slight deviations from the ordinary mode of performing operations should involve a medical man in a charge of malapraxis. We are not aware that this question has been hitherto raised in England.

When on these occasions there is a division of opinion among men of equal experience respecting the necessity for an operation or the proper performance of it, a practitioner who is made defendant has a right to expect that a verdict will be returned in his favour; since it is not to be supposed that, in order to answer a charge of unskilfulness, a man's practice should receive the unanimous approval of the *whole* of his professional brethren, especially in cases in which there is an acknowledged difference of opinion respecting the treatment. All that appears to be expected is a reasonable accordance in treatment with received professional doctrines.

CHAPTER 31.

CICATRIZATION OF WOUNDS.—EVIDENCE FROM CICATRICES.—CHANGES IN AN INCISED WOUND.—IS A CICATRIX ALWAYS A CONSEQUENCE OF A WOUND?—ARE CICATRICES WHEN ONCE FORMED INDELIBLE?—CHARACTERS OF CICATRICES.—THEIR AGE OR DATE.—CICATRICES FROM BLEEDING.—CUPPING, SETONS, AND ISSUES.—CICATRICES FROM BURNS.—CICATRICES FROM DISEASE DISTINGUISHED FROM THOSE OF WOUNDS.

Cicatrization of Wounds.—The time at which a particular wound was inflicted may become a medico-legal question, both in relation to the living and the dead. The identity of a person, and the correctness of a statement made by an accused party, may be sometimes determined by an examination of a wound or its cicatrix. So, if a dead body be found with marks of violence upon it, and evidence adduced that the deceased was maltreated at some particular period before his death, it will be necessary for a practitioner to state whether, from the appearance of the injuries, they could or could not have been inflicted at or about the time assigned. A case was tried (Taunton Spring Ass., 1841, *Reg.* v. *Raynon*) wherein evidence of this kind served to disprove a statement made by the accused. The prisoner was charged with maliciously cutting and wounding a woman. There was a cut upon his thumb, which he accounted for by saying it was from an accident that had occurred three weeks before. The medical witness declared, on examining it, that it could not have been done more than two or three days, which brought the period of its infliction to about the time of the murderous assault. This with other circumstances led to a conviction.

An *incised* wound inflicted on the living body, not treated antiseptically, gradually heals by adhesion, when no circumstances interfere to prevent the union of the edges. For eight or ten hours the edges remain bloody; they then begin to swell, showing the access of inflammation. If the parts are not kept well in contact, a secretion of a serous liquid is poured out for about thirty-six or forty-eight hours. On the third day this secretion acquires a purulent character. On the fourth and fifth days, suppuration is fully established, and it lasts five, six, or eight days. A fibrous layer, which is at first soft and easily broken down, then makes its appearance between the edges of the wound: this causes them gradually to unite, and thus is produced what is termed a *cicatrix.* Cicatrization is complete about the twelfth or fifteenth day if the wound is simple, of little depth and width, and affecting only parts endowed with great vitality. The length of time required for these changes to ensue will depend: 1. On the situation of the wound; wounds on the legs are longer in healing than those on the upper part of the body. If a wound is situated near a joint, so that the edges are continually separated by the motion of the parts, cicatrization is retarded. 2. On the extent; a deep or wide wound is long in undergoing cicatrization. Wounds involving many and different structures are also longer in healing than those simply affecting the skin and muscles. 3. On the age and health of the wounded person; the process of cicatrization is slow in old persons, as well as in those who are diseased and infirm. In an incised wound the cicatrix is generally straight and regular; but it is semilunar if the cut is oblique. It has been said that the cicatrices of incised wounds are rectilinear, but this is not always the case; in general, they are more or less elliptical, being wider in the centre than at the two ends—this appears to be due principally to the elasticity of the skin and the convexity of the subjacent parts; thus it is well known that in every wound on the living body the edges are more separated in the centre than at the ends, and this physical condition influences the process of cicatrization. When the wound is in a hollow surface, or over a part where the skin is not stretched, as in the armpit or groin, then the cicatrix may be rectilinear, or of equal width throughout. If there were any loss of substance in an incised wound, or if the wound were lacerated or contused, the cicatrix would be irregular, and the healing would proceed by granulation. The process might then occupy five, six, or eight weeks, according to circumstances. When healed, the cicatrix would be white, and if there had been a loss of substance it would be depressed and present a puckered appearance; the surface of the skin would be uneven. (See Krügelstein, Henke's 'Zeitschr. der S.A.,' 1844, b. 2, s. 75.) Under antiseptic treatment suppuration of wounds is in a great measure avoided.

Is a Cicatrix always a Consequence of a Wound?—Assuming that the term 'wound' implies a breach of continuity affecting the layers of the true skin (cutis), a cicatrix is always produced in the process of healing. Slight punctures or incisions with a lancet, and even leech-bites, affecting only the surface of the cutis, may leave no trace after a few weeks or months. In an even cut made by a very sharp instrument, especially if it is in the direction of the fibres of subjacent muscles, and the parts are kept in close contact, the cicatrix is even, linear, and sometimes so small as to be scarcely perceptible; and, if the skin is white, it may be easily overlooked. Wounds of this kind are not, however, commonly the subject of medico-legal inquiry. If, on examining a part, where at some previous time a stab, cut, or burn involving the cutis is alleged to have been inflicted, we find no mark or cicatrix, it is fair to assume that the allegation is false, and that no wound has been inflicted, making due allowance for the fact that mere abrasions of the cuticle, or very slight punctures and incisions, often heal without leaving any well-marked cicatrices.

A trial took place at the Old Bailey in 1834, in which a man was wrongly charged with being a convict, and with having unlawfully returned from transportation. The chief clerk of Bow Street produced a certificate, dated in 1817, of the conviction of a person, alleged to be the prisoner, under the name of Stuart. The governor of the gaol in which Stuart was confined believed the prisoner to be the person who was then in his custody. The guard of the hulks to which Stuart was consigned from the gaol, swore most positively that the prisoner was the man. On the cross-examination of this witness, he admitted that the prisoner Stuart, who was in his custody in 1817, had a wen on his left hand; and so well marked was this that it formed a part of his description in the books of the convict-hulk. The prisoner said his name was *Stipler*: he denied that he was the person named Stuart, but from the lapse of years he was unable to bring forward any evidence. The recorder was proceeding to charge the jury, when the counsel for the defence requested to be permitted to put a question to an eminent surgeon, Carpue, who happened accidentally to be present in court. He deposed that it was impossible to *remove such a wen as had been described without leaving a mark or cicatrix.* Both hands of the prisoner were examined, but no wen, nor any mark of a wen having been removed, was found. Upon this the jury acquitted the prisoner.

The cicatrices resulting from wounds after the performance of *surgical operations* are commonly well indicated by their regular form and their situation. They may present the characters of punctured or incised wounds, or a mere division of parts for the excision of tumours. As the healing process is assisted by art, the cicatrices are commonly marked by great regularity. The identity of a living person, or of a dead body, may be proved by the existence of a cicatrix which has been the result of a surgical operation. There can be no pretence for saying that such cicatrices, when they have involved the true skin, disappear. Whether the arm is wrinkled or unusually fat, the cicatrix may be found if it has ever existed.

A case in which this question respecting the permanency of cicatrices from wounds was raised, was referred to the author under the following circumstances. (*Reg.* v. *Reed* and *Donelan*, Chelmsford Spring Ass., 1842.) The medical evidence was to the effect that 'there was a wound on the nose of the woman, apparently inflicted by some sharp instrument, and the bridge of the nose was broken down. The weapon had entered half an inch, and had caused profuse bleeding. The wound was so deep that if it had entered a little higher up in the eye, it might have caused death.' In the defence it was urged that no weapon had been used; and that, although the male prisoner had struck the wounded woman a blow, the female prisoner had taken no share in the assault. It does not appear that any medical evidence was called to show in what state the assailed person was at the time of the trial. It was assumed that a weapon must have been used, and the prisoners were convicted, the one of stabbing, and the other of aiding and abetting. About six months after the alleged stabbing, and some weeks after the prisoners had been convicted and sentenced to punishment, the face of the injured woman was examined by two surgeons (one of them a practitioner of twenty-eight years' standing), and they both deposed that there was no mark of a cicatrix from a stab, or fracture of the nose, or of any personal injury whatever. Other surgeons were requested to examine her face, but this she declined permitting; and, as there was no power to compel her, the medical facts of the case were referred to Quain, Guthrie, Key, and the author. The evidence of the surgeons at the trial was laid before them, with the statements of the two surgeons who subsequently examined the woman. They all agreed that, if such a wound as that described in the medical evidence had been inflicted, there would have been a visible cicatrix and a ridge or prominence indicative of the situation where the bridge of the nose was stated to have been broken; and as no such marks could be perceived by two well-informed surgeons, they considered it improbable either that such a wound as that described could have been inflicted, or that a weapon could have been used in the assault. The question really to be decided was—Could all traces of such a wound as that above described, be effaced in a period of six months or even during the life of a person? Either the wound must have been misdescribed, or some marks of its past existence, in the form of a cicatrix, would unquestionably have been found. In *Barnett* v. *Roberts* (Court of Exch., Nov. 1867), an action was brought by a surgeon, for injury resulting from an assault by the defendant. It appeared from the evidence that the defendant struck the plaintiff two violent blows on the head with the handle of his umbrella. It was alleged that this had caused a fracture of the skull, and had produced a long and painful illness. Erichsen and Winslow gave evidence for the plaintiff to the effect that in their judgment the skull was fractured, the brain organically injured, and the plaintiff's recovery rendered practically hopeless. On the other hand, for the defence, Partridge and Wood, with other witnesses, deposed that the skull was not fractured, and that the depression supposed to indicate the fracture was congenital and not the result of a blow or accident. A skull with a natural depression in it was produced and shown to the jury. The plaintiff's head was examined in court by Partridge. He could feel no cicatrix in the alleged seat of injury, but there was a thickening over the depression. On this evidence the jury could not agree. There would be no difficulty in such a case if a careful examination was made soon after the assault; but when surgical opinions are taken some weeks or months afterwards, the witnesses may disagree. Even if there had been a cicatrix on this occasion, this would not have proved that the skull had been fractured. The injury to the brain might well have been a result of the violence, although there had been no fracture.

Characters of Cicatrices. Their Age or Date.—In an early stage a cicatrix is softer and redder than the surrounding skin, but after some months or years it becomes white, hard, smooth, and shining. The fibrous substance of which it is formed receives less blood than the uninjured skin; hence, on compressing the skin around an old cicatrix, its situation and form are well marked by reason of the blood not readily entering into it on removal of the pressure. As the age of a cicatrix increases, it becomes smaller, thicker, whiter, more shining, and less sensitive. It is fibrous in structure, dense, without sebaceous follicles, adipose cells, or hairs, and it contains but few absorbents and exhalants. The time required for these changes to take place cannot be defined. In one person they may be observed in a few months, and in another only after some years. The tissue of which an old cicatrix is formed is different from that of the skin; it is harder, contains less blood, and is destitute of any coloured pigment, so that its whiteness, which is remarkable on the cicatrized skin of a negro, is retained through life. If any cicatrices were easily obliterated, it would be those which are even and regular—the results of incised wounds by sharp instruments; but cicatrices of this kind have certainly retained their characters unchanged in one instance for twenty, and in another for twenty-five, years. According to the observations of Dupuytren and Delpech, the substance of a cicatrix is not converted into true skin—it never acquires a rete mucosum, *i.e.* the membrane which gives colour to the skin. Although this is generally true of incised and punctured wounds, yet contused and lacerated wounds on the legs of persons advanced in life frequently present a brown discoloration from the deposit of a brown pigment. In the cicatrices of lacerated and contused wounds, the form of the weapon with which the wound was inflicted is sometimes indicated. It is not, however, easy to distinguish the cicatrix of a stab of old date from that produced by a pistol-bullet fired from a distance. In both cases the edges may be rounded and irregular, and the cicatrix puckered, unless the stab has been produced by a broad-bladed weapon. If no mark of cutting can be perceived within a few months of the period at which a severe wound is alleged to have been inflicted, it is reasonable to infer that there has been some mistake, or that the circumstances have been exaggerated. Cicatrices increase in size during the process of growth. Adams found, in the case of an infant who had been operated on, a cicatrix doubled in length and greatly increased in width after eighteen years. Vaccination scars in the adult are frequently seen from one-half to three-quarters of an inch in diameter, the increased size from the original puncture arising from the growth of the cicatrix. ('Brit. Med. Jour.,' 1873, ii. p. 684.) Paget has made a similar observation. The growth takes place *pari passu* with the body. ('Lect. on Path.,' vol. i. p. 49.)

It is important to observe that all cicatrices are of smaller size than the original wound, for there is a contraction of the skin during the process of healing. This is especially noticed with regard to the cicatrix of a *stab,* which is frequently of a triangular form. A recent stab, owing to the elasticity of the skin, is smaller than the weapon; and the resulting cicatrix is always smaller than the wound. Hence it is difficult to judge of the size of the stabbing instrument from an examination of an old cicatrix. Cicatrices arising from a loss of substance in the cutis, or true skin, are usually indicated by a depression. In gunshot-wounds, if the projectile has been fired from a distance, the cicatrix is of smaller dimensions than the ball. It represents a disc depressed in the centre, and attached to the parts beneath, while the skin is in a state of tension from the centre to the circumference. The amount of depression is great in proportion to the quantity of cellular membrane beneath. If the bullet has been fired near to the body, the cicatrix is large, deep, and very irregular. In this case there may be the bluish mark of tattooing from the gunpowder carried into the skin. If the projectile has made two apertures, the aperture of exit is known by the greater size and irregularity of the cicatrix. (See 'Edin. Month. Jour.,' 1854, vol. 10, p. 370.)

There are no appearances in a cicatrix which will allow us to fix the *date* at which the wound leading to its production was inflicted, and it is often most difficult to say how or by what means it was inflicted. If the person is living, he may give a description of the injury and the date of its production, which may be consistent or inconsistent with the appearances presented. As Casper justly remarks, it requires more than two, three, or four weeks to produce the hard white shining appearance of an old cicatrix; but when it has once acquired these characters, there are no medical data for enabling us to determine whether the injury was inflicted two, three, or even ten years before.

A proper attention to the number, situation, and appearances presented by cicatrices on the living or dead body, will, however, sometimes enable a medical witness to establish or disprove the identity of persons.

Cicatrices from Wounds or Disease. Imputed Cicatrices.—As there are imputed wounds, so there may be imputed cicatrices. It is rare to hear of frauds of this description: the wound must be made in anticipation at a long date in order to give the appearance of an old cicatrix; the part wounded must be selected in order to carry out the fraud; and the person producing the wound may carry the incision or puncture too deeply or too superficially, and thus lead to detection. It is more likely that an impostor may seek to gain his object either by attributing the cicatrices of wounds accidentally received to other causes, or by ascribing cicatrices which have resulted from disease to some particular cause occurring in early life. Thus an impostor with old scars upon his person may make use of them as proofs of identity. Such scars may really exist; they may be clearly proved to be of old date, and they may be assigned to causes which cannot be disproved except by a close medical examination. The scars or cicatrices may have arisen from scrofulous ulcers or abscesses, in which case it would not be difficult to distinguish them from the cicatrices of wounds. In the case of *Smyth* v. *Smyth* (Gloucester Sum. Ass., 1853), the plaintiff claimed to be the rightful heir to certain estates occupied by the defendant. He based his claim upon some deeds (alleged by the defendant to have been forged), in which it was stated that the lost heir to these estates would be known by certain marks on his right hand and wrist, suggested to have been received at the time of his birth, in 1797, by reason of his having been brought into the world with instruments. It was one of the curious features of this extraordinary case of imposture that no medical opinion was taken or required by the claimant, on the probable nature and origin of these marks. When requested at the trial to show his hand to the jury, the mark had the appearance of a puckered cicatrix from a scrofulous ulcer near the wrist. Similar marks from scrofulous sores were seen upon his neck. His statements regarding himself, and the circumstances on which he based his claim, were so improbable and contradictory that the case speedily broke down. A question of this kind may occasionally present some difficulty, but a close examination of the cicatrix, with a consideration of the statement of the person on its mode of production, will enable a practitioner to arrive at a satisfactory conclusion respecting its origin. *Scrofulous* ulcers are generally observed to leave irregular and deeply furrowed cicatrices, with smooth depressions, surrounded by hard and uneven margins. According to Schneider, the *scorbutic* cicatrix is at first dark, bluish-red in colour, soft to the touch, somewhat raised and rather painful; in the course of time it becomes flatter, of a reddish-brown colour, very thin and easily injured. *Syphilitic* cicatrices are characterized by great loss of substance; they approximate the margins of the deep ulcers before their granulations have had time to reach the surface. *Glandular* cicatrices are irregularly tumefied, generally deep, hardened, and of a reddish-brown colour. These varieties cannot easily be mistaken for the cicatrices of wounds; but it is not so easy to distinguish them from each other. Malle remarks that the form and shape of the cicatrix depend less on the cause producing it than on its anatomical position. The elasticity of the skin, the looseness or density of the cellular tissue beneath, the depression or convexity of the surface and the tension of the muscles, are circumstances which will modify the form of the ulcer and the cicatrix proceeding from it. ('Ann d'Hyg.,' 1840, 1, 430.) An expert can seldom do more than distinguish the cicatrices of ulcers arising from morbid causes, from those which have resulted from violence. Cicatrices in the inguinal regions raise a presumption that they are of *syphilitic* origin, but it is impossible to say that they may not have been derived from simple abscesses. The cicatrices of *scrofulous* ulcers have some resemblance to those produced by firearms, but it may be presumed that they are of a scrofulous origin when they are situated in the region of the neck, below the jaw, or in the course of the parotid gland, especially when there is any enlargement of the neighbouring glands. A puckered and folded state of the skin around the cicatrix would confirm this opinion.

Is a cicatrix, when once formed, ever removed or so altered by time as to be no longer recognizable?—This is a question which sometimes presents itself to a medical jurist both in civil and criminal proceedings. When a cicatrix has been produced by the healing of a wound involving a loss of substance in the cutis or true skin, it is permanent. In wounds involving the whole substance of the skin, the cicatrix which is once formed does not disappear, although it may undergo some changes and become less distinct in after-life. Wounds which heal by suppuration and granulation generally leave behind them cicatrices which remain for life. The marks arising from the pustules of vaccination, small-pox, herpes zoster, and those produced by setons and issues, leave cicatrices easily recognizable at any period. Cicatrices of wounds made after the completion of growth do not increase in size: they retain the same proportions through life. When the substance of the skin has been penetrated, it retracts, owing to the yellow elastic fibrous tissue which it contains, and the gap thus made is filled up with white fibrous or cicatrix tissue, which forms a marked contrast with the surrounding skin. This may be seen in the cicatrices of the apertures made by bleeding, or in the scars left by herpes zoster. This cicatrix tissue, or connective tissue, as it is called, when once formed, is permanent. It never wears out or wastes.

A man may allege, in proof of his identity, that at a former period of his life he was bled in the arm, or foot, or in the temporal artery, that he had undergone cupping, or that he had had a seton or issue in his arm. The simple questions for a medical witnees will then be—Are the marks left by these operations present? Are they visible in the situations in which such operations are usually performed? Do they present such cicatrices as would be likely to result from the alleged operations? If not visible at the time of examination, is it or is it not probable that they may have spontaneously disappeared by lapse of time? These simple questions may carry with them momentous issues, either in a civil or criminal case.

With regard to *cupping*, when the operation is properly performed, the numerous small and slightly elliptical cicatrices are well indicated by their whiteness and symmetrical position. The cicatrix left by the use of the lancet in *bleeding* from a vein in the arm or foot is similar to that of cupping—white, linear, slightly elliptical, with its length in the direction of the vessel, and not across it. About fifty years ago, bleeding from the arm was a frequent operation, the same person requiring to be bled at spring and fall. The cicatrices that resulted were always perceptible; in some instances, when the person had been bled several times in or near the same part of the vein, a hard or knotted white cicatrix was produced, rising above the level of the skin. There is no reason to believe that such a mark, involving as it does the whole cutis, ever disappears. Beck quotes the case of a child, which had been bled in the right arm when sixteen months old. When nearly four years old the child was lost, and two years subsequently, the godmother, seeing two boys pass, was struck by the voice of one of them; she called him to her, and was convinced that it was her lost godson. The identity was also considered to be proved by the discovery of a cicatrix from bleeding in the right arm, and a cicatrix from an abscess in the left knee, both of which were present in the lost child, and also in the one that was found. The latter, however, had upon his body marks of the small-pox, while no marks of this kind were on the body of the former. The child was claimed by a widow (*Labrie*), and many witnesses deposed that it was really her son. The court decided in her favour, chiefly on the ground that the lost child was not marked with the small-pox. ('Med. Jur.,' vol. i. p. 655.) It was admitted that this child had in the arm and knee, cicatrices, similar to those which were known to exist in the one that was missing, and had the medical witnesses agreed about the causes of them, it is probable that the decision would have been different. The cicatrix at the knee was ascribed to the use of caustics by some of the surgeons, and to a slight abrasion by others. The widow admitted that her child had never been bled in the arm, while the missing child had certainly undergone this operation; but on the question as to the presence of a cicatrix from bleeding, there was a conflict of medical opinion. Three surgeons examined the cicatrix, and declared that it had been made with a sharp instrument. Others deposed that it was not a cicatrix from bleeding, but from the opening of an abscess. As the child had been missing two years, it might have had the small-pox in the mean time. If a proper examination of the two cicatrices had been made by medical assessors appointed by the Court, this conflict of medical opinion would not have arisen, and the decision might have been different.

According to Casper, the cicatrix left by venesection may sometimes disappear, although he adduces no fact in proof of it ('Gerichtl. Med.,' vol. i. p. 113); ordinary surgical experience is against it. Devergie correctly states that every wound which involves the thickness of the skin (cutis) leaves a cicatrix which is indelible. ('Méd. Lég.,' vol. ii. p. 217.) According to him, it may become less distinct by time, but it never entirely disappears. In all contested cases of this kind, where there is ample room for a difference of opinion, it would be more satisfactory to take the evidence of skilled medical assessors appointed by the court, than to receive that of medical men specially selected by solicitors to uphold their different views of the case. This would be giving its true value to medical testimony, in aiding, by a proper interpretation of physical signs, to clear away the doubts which necessarily arise by trusting to a supposed remembrance of the features, voice, and gesture, after the lapse of many years.

At the celebrated Tichborne trial (*Reg.* v. *Castro*, Q. B., 1873), the possibility of the disappearance of scars was made a matter of great importance as bearing upon identity. Roger Tichborne, the missing baronet, whilst on the ship *Pauline*, met with an accident by which a fish-hook passed clean through one eyelid, and had to be pulled through and out; and it was truly alleged that such a wound would leave a scar, and that this would probably be indelible. He had also been bled, an operation which usually leaves indelible scars. It was also certain that, when a lad, Roger had either an issue or a seton on his left arm. According to the prosecution, it was an issue, and was kept open by a pea. According to the defence, it was a seton. On the defendant's arm there was the mark neither of an issue nor of a seton. Moreover, there was no scar on the eyelid such as would have been produced by the fish-hook. Further, Roger had his temporal vein opened when a young man; and there was no scar on the defendant's temples. Although it must be admitted that a venesection-mark may disappear in the course of time, it is in the highest degree improbable that several cicatrices such as have been described would all disappear. The defendant was convicted of the attempted imposture; or rather of perjury in swearing at the first (civil) trial that he was the veritable Sir Roger Tichborne. In the case of venesection-marks, a medical jurist may be required to give an opinion on the cause and date of their production; and in the case of the alleged disappearance of scars, he may be required to say whether—assuming them to have once existed—they could have disappeared, either from natural causes, or from chemical or other means employed to obliterate them. (See p. 331, *post.*) In some countries it is the custom to brand convicts, and the cicatrix from the brand-mark—a letter burnt into the skin—is regarded as the strongest proof of identity.

By a remarkable coincidence, two persons may have cicatrices on or about the same part of the body, produced by cuts, punctures, or abscesses in early life; and serious mistakes may be made under these circumstances. A case is reported to have occurred in France, in 1794, in which a man named *Lesurgues* was tried, convicted, and executed for robbery and murder. There were some doubts at the time as to his identity; and strong exertions were made to save his life. Soon after his execution, the real murderer was discovered, between whom and

Lesurgues, who had had no hand or part in the crime, there existed a wonderful resemblance in stature, complexion, and features. But the most extraordinary part of the case was that Lesurgues, like the real criminal, had a cicatrix or scar on the forehead, and another on the hand; and there is no doubt that these points of resemblance, which upon a proper scientific examination might have been proved to be really different, became the turning-point of the case, and led to the conviction of an innocent person.

The parts selected for *setons* or *issues* are generally about the shoulder, the nape of the neck, or the upper arm. The situation of the cicatrices might thus serve to throw some light on their origin. The cicatrix left by an *issue* cannot be mistaken for the cicatrix caused by a seton. In the first place, it is single, depressed below the level of the skin, and rounded in its margin; and, as in all cases in which the cutis is destroyed, it remains as an indelible mark. It is impossible by any process to restore to the skin its uniformity and evenness of surface. Malle has pointed out that the double cicatrix which is left by the application of a *seton* may present an appearance which might be mistaken for the entrance and exit-apertures of a bullet, since in both cases a band of hardened lymph may be felt between the two cicatrices. When a hard band of connection cannot be felt between them, the marks cannot be owing either to a bullet or a seton, but they may be due to a bite, or to separate wounds produced in the skin at or about the same time.

With respect to *blisters*, they produce only a superficial and temporary reddening of the cutis. They do not commonly leave a scar, unless their irritant action has extended to the substance of the cutis, and has led to ulceration and suppuration; the ulcerated being separated from the non-ulcerated portions of the skin, and indicated, according to Dupuytren, by an indelible brown mark.

The cicatrices left as a result of the application of the true *vaccine* lymph have a peculiar irregular honeycombed appearance, with white streaks slightly depressed below the level of the surrounding skin. The spurious vaccine-mark is of a reddish colour, not depressed, and not presenting the honeycombed appearance and white streaks of the cicatrix of the true pustule.

The scars produced by *small-pox* are in the form of deep depressions, showing a complete destruction of the cutis.

Independently of the cicatrices from local injury, these cases of contested identity may present other physical signs, such as *moles*, *nævi materni*, and other congenital defects to which ordinary witnesses may be able to testify. There can be no fallacy of memory touching the form, size, and position of such marks, and they differ from cicatrices in this —they cannot be artifically imitated. They may, it is true, be removed, but only by actual cautery or caustic applications. If thus removed, a cicatrix is left in the skin which is indelible. A case is reported by Beck, in which a girl, *Salomé Muller,* had been sold as a slave, but her identity as the child of German parents was proved after many years by two marks resembling moles about the size of coffee-grains, on the inside of the thighs. They were proved to have existed in the child, and they were proved to exist in the same parts of the body of the girl eighteen years afterwards. After much litigation, she was, upon this evidence, pronounced to be a free woman. ('Med. Jur.,' vol. i. p. 662.)

Cicatrices from Burns.—This subject has been fully investigated by Malle. ('Ann. d'Hyg.,' 1840, t. 1, 422.) A superficial burn, in healing, produces a broad irregular cicatrix, varying with the form of the burning body. If the burn has extended to some depth below the cutis, the cicatrix is deep, and has a rounded margin; but in the depression, it is irregular and contracted in proportion to its depth. Solid caustics produce cicatrices with regular edges, as the corrosive substance easily penetrates uniformly through the deep layers of the skin. Caustic liquids produce only superficial marks unless they have been allowed to penetrate deeply, when, by the destruction of parts, they may give rise to deep and irregular cicatrices. When the cutis is destroyed, an indelible cicatrix remains, whether it is the result of a burn from a heated solid, or from the chemical action of a highly corrosive liquid. In a case in which the strongest nitric acid was applied to the skin for the removal of a mole, the cicatrix produced was visible after twenty-five years.

In the celebrated Whitechapel murder case (*Reg.* v. *Wainwright*, C. C. C., Nov. 1875), the body of the deceased woman, Harriet Lane, was identified, spite of decomposition, and a year after death, by the presence of an old scar on the leg, the result of a burn.

The subject of cicatrices as they are found in the neck, whether arising from wounds, scrofulous disease, or burns, has been fully examined by Güterbock, in an elaborate paper. ('Vierteljahrsschr. für Gerichtl. Med.,' 1873, 2, p. 84.)

CHAPTER 32.

MEDICAL EVIDENCE OF IDENTITY FROM COLOURED CICATRICES OR TATTOO-MARKS.—MODE AND DATE OF PRODUCTION.—DURABILITY OF THESE MARKS.—THEIR ALLEGED SPONTANEOUS DISAPPEARANCE.—CASES OF IDENTITY FROM TATTOOING.—SIMULATED MARKS.—TATTOO-MARKS ON THE DEAD.—MEDICAL RESPONSIBILITY.

THE subject of tattooing has been noticed by medical jurists. Several trials have occurred of late years in France and Germany which show the great importance of this subject in cases of contested personal identity. The *Tichborne case* (see p. 321, *ante*), which occupied our law-courts for nearly two years, involved some issues of importance in relation to identity from cicatrices and the marks of tattooing. The presence of tattooed or coloured marks on the skin of a person, verified by a competent observer, may become the strongest possible proof of identity, and their proved absence, if not accounted for or explained, may furnish the most convincing evidence of non-identity. An escaped convict may allege that he never was tattooed. There may be no coloured marks on his skin, but a medical expert may be able to demonstrate that there have been such marks, and that traces of them still exist. A man who is found to be tattooed may, in order to escape punishment, pass himself off as another person, also tattooed. In this case medical evidence must be derived from a comparison of the colour, form, and situation of the marks in the two. A tattooed man may claim an estate, and adduce the tattoo-marks as a proof of his identity. It would be difficult for an impostor setting up a false claim to simulate marks of this kind. The operation would require time and an accurate imitation of the colour and design, as well as of the part of the body selected. Members of the family would be able to say whether they were or were not such marks as those which had existed on their missing relative. There may be satisfactory proof that the missing person was tattooed, while an impostor may allege that he had not been tattooed. The fact, however, may be that at some former period of his life a man had undergone this operation, and, to prevent a discovery of his identity, he had removed the marks by cautery or other means. As the presence of tattoo-marks, and their correspondence in situation, colour, and design with those on a missing person, would furnish the strongest possible evidence of identity, so their absence in a given case, unless clearly explained, must be considered as the best proof of non-identity.

Coloured Cicatrices. Mode and Date of Production.—These marks arise from small punctured wounds made into the true skin with three or four sharp needles closely bound together. The needles are dipped in colouring matter at each time that the punctures are made. When the substance of the cutis is penetrated, as it ought to be in order to leave a permanent mark, there is in a few hours much swelling of the skin, with general inflammation. The colours commonly employed in tattooing are charcoal (gunpowder), China-ink, vermilion, and indigo. Other vegetable colouring matters of a fugitive kind are sometimes used. China-ink and charcoal, although black, produce designs on a white skin which have a bluish tint. The colouring matter thus deposited mechanically in these minute punctured wounds, after the first attack of inflammation has passed off, remains permanently encysted in the substance of the cutis or true skin and in the cellular membrane below it. It has been there found after death. According to Berchon, the local symptoms of irritation and inflammation last about a fortnight. At the end of the first month the lines of colour appear wider than they will be ultimately. About the sixth week, the cuticle begins to scale off; and at the end of about two months, or a somewhat longer period, the skin acquires its normal condition. The designs in vermilion are at this early time much more intense than those in China-ink. When the local symptoms have subsided, the tattoo-marks are fixed, and it is impossible to assign a date to them.

Durability of the Marks. Alleged Spontaneous Disappearance.—In imperfect cases of tattooing, when soluble and fugitive colours are used and the surface of the cutis only is penetrated, the marks may disappear or be removed by artificial means. Not so when the colouring matter is carried completely into the substance of the cutis or true skin. It there forms an intimate combination with the fibrous structure of the skin, and remains permanently fixed. Rayer has shown by the maceration of tattooed skin that the cuticle may be removed, and it is colourless as in ordinary skin. This, therefore, proves that the colouring matter is firmly imbedded in the cutis and cellular tissue below it. ('Ann. d'Hyg.,' 1855, t. 1, p. 194.) A maceration of the skin in water for two months did not affect the colour of the tattoo-marks, and Tardieu found that no solvent could remove the colouring matter without at the same time destroying the texture of the skin. Tattoo-marks are not removed, because the colouring matter is insoluble and cannot permeate the roots of the vessels. Silver marks are equally indelible, when deposited from taking inwardly the nitrate of silver. Finely divided substances, such as mercury, may penetrate; also finely divided charcoal, taken into the intestines, has been found in the mesenteric veins. In 1874, there was a case in Guy's Hospital that well illustrated the durability of these marks. The man, æt. 50, had been a sailor, and while in the China seas, from 1842 to 1847, he was tattooed at different times. There were numerous designs on both arms and the front of the chest, some of them artistically representing flowers and leaves, a flower-pot, and human figures. There were only two colours, blue-black and red, the former done with China-ink, the latter with vermilion. The operation had been performed by an English sailor. Three needles were used—these, dipped into the colour, were introduced deeply into the skin sideways, or in a valvular form, and the ink mixed with water was then well rubbed over. The vermilion was rubbed in, in powder. Some blood flowed, and after a few days the parts cicatrized, the scabs came away, and the man suffered no inconvenience. The marks were deeply imbedded in the cutis; some were deeper in tint and blacker than others, this result depending on the strength of the China-ink used. The colours had undergone no change up to 1874, although one of them at the back of the hand, representing a flower-vase with flowers, had been exposed to light and to frequent contact with water and other liquids, including naphtha, but it had made no difference in its appearance. The vermilion has also retained its colour. It is a remarkable coincidence that on his left arm were the capital letters 'R C T,' but these did not correspond to the initials of the name of the patient. The marks were unchanged after, at the lowest estimate, twenty-six years.

In most anatomical museums, preparations of tattooed skin may be seen. In Guy's Hospital Museum there are many. The designs have been produced with gunpowder, and some small portions with vermilion. In one of them, which has been preserved in spirit for forty years, the marks on the skin of the leg represent an animal like a goat; they are of a bluish-black colour. In the part from which the cuticle has been removed the colour appears much more intense. There is nothing to indicate that this preparation has undergone the slightest change of colour during its long maceration in spirit. This and the other preparations also show that no colour is removed by removing the cuticle;

on the contrary, the colour becomes brighter and more intense by contrast with the white surface of the cutis. Another preparation of the skin of the arm represents in blue-black (carbon) and red (vermilion) the Crucifixion, with the date—Nantes, 1808. In this also the cuticle has been removed in part, with the effect of bringing out the colours more strongly. Seventy-seven years have passed since these marks were produced, but neither while living nor in undergoing maceration in water and spirits after death, is there any appearance of change in the depth of colour or in the outlines of the design. In a third, the skin was taken from the arm of a sailor, who died in Guy's Hospital in 1857. The designs represent the arms of England, and Adam and Eve with the tree of life and the serpent. It has been noticed with regard to this preparation that the red or vermilion colour has become less marked during the years that it has been in the museum. Another preparation of the skin from over the scapula has simply a large letter 'D,' the brand of a deserter. This was removed from a dead body in 1860. A fifth, of the date of about sixteen years, represents, in a very perfect manner, a ship in full sail, with the figure of a woman. This portion of skin was taken from the body of a sailor. These facts show how durable the carbonaceous colours are when the substance has once penetrated the cutis. No amount of maceration appears in any way to affect or alter them.

A surveyor accidentally punctured the skin of the back of his hands with a sharp steel pen charged with China-ink. A bluish-black spot was formed after the healing of the wound; this was quite visible and unchanged after six years, and it would no doubt continue for life. A near relative of the author was tattooed with China-ink on the inside of the arm. The designs, which were of a bluish colour, remained unchanged up to his death, *i.e.* for the long period of twenty-eight years. It has been rather hastily assumed that in a certain percentage of cases, tattoo-marks spontaneously disappear in the course of time. Thus Hutin examined 506 cases of tattooing. Relying upon the statements made by soldiers, sailors, convicts, and others, his conclusion was that in 47 the marks were completely obliterated after a period of from twenty-eight to sixty years; in 117 the marks were partially obliterated after a period of from ten to sixty-four years; but in 342 the marks were quite distinct after a space of from four to sixty-five years. With the exception of two cases of tattooing in vermilion which disappeared after thirty years, Tardieu found that the disappearance of tattoo-marks did not take place until after thirty to forty years, and of the only two tattooings with China-ink which were obliterated, one disappeared after forty-five and the other only after sixty years.

These and similar facts show that in a few cases these marks may fade or become less visible, but this change requires a period of ten years at the least. The fading of the marks most probably arises, not from a removal of the colouring matter by the absorbents, but from the fact that in some cases the tattooing has been superficially performed on a thin skin. If the absorbents can remove from the tattoo-marks such insoluble colours as carbon and vermilion, it would scarcely require a period of from ten to twenty-eight years for their removal, and on this theory it would be impossible to explain why tattoo-marks remain permanent in any case. The subject has been considered by Horteloup. ('Ann. d'Hyg.,' 1870, t. 2, p. 453, and 1872, t. 1, p. 423.) It is said that the vermilion colour has been seen in substance in the neighbouring absorbent glands, but it does not appear that mercury has ever been detected in these glands (Casper, 'Gerichtl. Med.'), the crucial test of its presence.

The nature of the colouring material appears to have some influence on the durability of the tattoo-marks. Thus Hutin found that out of 78 persons who had been tattooed with vermilion alone, the tattoo-marks had disappeared in eleven, and that out of 104 tattooed with black pigment, such as carbon, China-ink, &c., not one had become obliterated. This permanency of the black pigment has also been noticed by other observers.

The general conclusion from these observations is that tattoo-marks once properly made in the *cutis* are practically indelible, but that when the operation is imperfectly performed, the marks may, in the course of many years, become lighter and disappear. This is observed more commonly with red colouring matter than with the black or carbonaceous colours. As accurate information can seldom be obtained respecting the tattooing in early life, it may be inferred in a contested case in which the marks are proved to have disappeared, that the tattooing was imperfectly performed. This point, however, admits of refutation when it can be proved that the marks are still visible on the arm of another, tattooed at the same time, by the same person, and with similar materials.

Removal of Tattoo-marks by Art.—Many absurd statements have been made by convicts respecting the removal of tattoo-marks from their skins. The only methods by which such marks admit of removal are by excision of the cutis, or the application of the actual cautery or escharotics to destroy the skin. In such cases cicatrices remain, which, under a proper examination, may lead to detection. A case occurred to Tardieu in which the fact of obliteration was the main question for solution. ('Ann. d'Hyg.,' 1855, t. 1, p. 201.) A man named *Aubert* was charged with having committed a robbery in 1843. His defence was that he was at that date confined in a certain prison under the assumed name of *Solignon.* On searching the prison-register it was found that a man named Solignon was there confined at the date assigned, and the description of the prisoner showed that he was tattooed on both arms—on the left there were two hearts, a dog, and other emblems; on the right a man, a woman, a dog, and two hearts. On examining the prisoner Aubert, no marks of tattooing were seen upon his arms, although he affirmed that he had been tattooed by a friend in 1840, and again in 1846, with a blue vegetable ink, but that he had some months previously removed the marks by a chemical process. He also described the marks: those on the right arm representing the bust of a woman and the letters 'J S,' and on the left a tomb, with foliage, &c. In 1846, a hunting scene had been added, but this was the faintest of all. By close examination of the skin with a lens in a strong light, Tardieu was able to detect faint white marks like cicatrices representing the outline of a tomb, with two hearts; and the marks indicative of two letters were also detected on the skin of the other arm by the same means. By these observations, the non-identity of the accused Aubert with the former prisoner Solignon was clearly proved. Both were tattooed, but the tattoo-designs were quite different, and under less skilful hands than those of Tardieu, Aubert might have escaped the punishment which he merited.

The prisoner Aubert communicated to Tardieu the plan which he had adopted for removing the tattoo-marks. He first applied an ointment of strong acetic acid, then a weak solution of potash, and afterwards hydrochloric acid. The skin which had been removed by these caustics was gradually reproduced; but although the colouring material was removed, linear cicatrices were left in the skin in every part to which the tattooing-needles had been applied. Tardieu subsequently tried this process on some tattoo-marks, and found that the colouring matter might be thus removed, but that traces indicative of the original designs were still left in the skin. Simple friction of the skin will sometimes suffice to bring out obliterated tattoo-marks. An escaped convict was on trial before a French court, and the question turned upon his identity with a prisoner known to have been tattooed. There was no appearance of coloured marks upon his arm, and the question submitted to Leroy was whether the man had ever been tattooed. Leroy applied strong friction to the skin of the arm. This had the effect of bringing out cicatrices as white lines with a slight bluish tint. By this means the word 'Sophie' was plainly legible in white marks on the reddened skin. This fixed the identity of the convict. ('Ann. d'Hyg.,' 1870, t. 2, p. 460.)

As perfect tattooing cannot take place without deeply wounding the cutis and causing a cicatrix, we must not trust to the absence of colour only when an opinion is required whether the person has or has not been tattooed. These observations equally apply to the destruction of the marks by fire. Horteloup examined the arm of a man, æt. 42, who at the age of 18 had been tattooed with China-ink. At the age of 30 a bar of iron, at a white heat, accidentally dropped on the tattooed portion of his arm. Twelve years after this accident Horteloup found a white cicatrix on the arm which had obliterated part of the design (a ship). When the obliterated portion was minutely examined with a lens, faint white lines were seen which filled up and completed the figure of a ship. ('Ann. d'Hyg.,' 1870, t. 2, p. 459.) Bois de Loury met with an instance which proves that it is very difficult to eradicate the tattoo-marks without leaving distinct cicatrices of them. In this case a man had a number of initials of names spread over the skin of his chest and arms, and in many parts he had obliterated the letters by a red-hot iron applied to the skin,—but in every instance there was a well-defined cicatrix, and it was still possible to make out traces of the letters. ('Ann. d'Hyg.,' 1872, t. 1, p. 423.)

Tattoo-marks on the Dead.—When we are required to examine a dead body for marks of tattooing, great caution is required if no coloured marks are apparent on the skin. Putrefaction, unless very far advanced, does not interfere with their appearance. Tardieu states that, in examining the partially decomposed body of a man who had been a carpenter, the tattoo-marks on his arm clearly represented the instruments of his trade. When the question is whether the marks have been on the arm and subsequently removed, there will be some difficulty. An examination of the skin with a lens in a strong light may show the presence of lines corresponding to cicatrices; but the evidence derivable from friction of the skin is here lost. Horteloup recommends the examination of the neighbouring absorbent glands for the colouring matter; but if the marks are of many years' standing, colouring matter is not likely to be found in them. In this respect a case which occurred to Casper is eminently instructive. In 1849, the body of a man, decapitated, was found in the neighbourhood of Berlin. It was supposed to be that of one *Gottlieb Ebermann*, who was missing. It was stated that the body of Ebermann could be identified by marks of cupping on the wrists, an operation performed on him eight or nine years before his death, and also by tattoo-marks of a heart and the letters 'G E' on the left arm. On an examination of the body no marks of any kind could be perceived, and Ebermann's wife, who had been married to him two years, and his three sisters, affirmed that they had never seen any tattoo-marks on him. The body was exhumed after five months, but owing to putrefaction no further evidence could be obtained from it. A man of the name of *Schall* had been in the mean time charged with the murder, and the circumstantial evidence was so strong against him that nothing more was required than to prove that the body found was that of Ebermann. Of two medical experts who were called to give evidence, one deposed that the marks of cupping could always be distinguished, and those of tattooing were indelible; the other stated that the marks of cupping might spontaneously disappear, but with regard to the tattooing he could give no opinion. As this medical evidence failed to establish the identity of the body, the opinion of Casper was required by the court. In his report, taken from the observations made in a large asylum for aged and invalid soldiers, a class among whom tattoo-marks are common, he stated that out of 36 examples, in three the tattooing had become faint with time; in two the marks were partially effaced; in four they were completely obliterated; hence he came to the conclusion that the marks of tattooing may disappear. A witness came forward and declared, during the investigation, that at fifteen he had tattooed himself on the arm with vermilion, and that the marks had become entirely effaced. The conclusion of the trial was that Schall was condemned. ('Med. Times and Gaz.,' 1852, ii. p. 608; also Casper's 'Gerichtl. Med.,' 1, p. 116; and 'Vieteljahrsschr. für Gerichtl. Med.,' 1852, 1, p. 274, and 1853, 1, p. 338.) The singular part of this case is, that there was a want of proof that the deceased had really been tattooed; for neither the wife who had cohabited with the deceased for two years, nor his three married sisters, had ever seen any tattoo-marks on his skin. Chereau ('L'Union Méd.,' Nov. 16, 1852) justly observes, respecting Casper's report, that it is not one which should influence a judicial decision, for it is not stated at what age, with what substances, and in what manner, the marks were produced in the four instances where there was complete obliteration. Were the men to be trusted? How many years had really elapsed before the marks had become effaced? What was the nature of the colouring matter used? Was it mineral or vegetable? and was it carried deeply into the cutis, or only disposed on the surface? These questions should have received satisfactory answers before comparisons were made, and important medical conclusions were based upon them. Casper's unqualified opinion that such marks, assuming them to have existed, might have spontaneously disappeared, led to the conviction and execution of Schall. The accused confessed his crime before execution, but the position assumed by Casper on this occasion is certainly not a precedent to be followed by medical jurists. In all cases in which an opinion is required of a medical man—whether tattoo-marks have been effaced from the skin or not—there should be no doubt whatever touching their previous existence.

A question may arise in contested identity, whether any accidental or temporary marks made on the skin can be mistaken for tattooing. This does not seem at all probable. The colour and the design might be imitated by water-colour pigments, but this would be only superficial, *i.e.* on the cuticle, and they would be readily removed with water. No professional man could be deceived by such an attempt at imposture. It may be suggested that marks of tattooing said to have been seen by witnesses on the skin of a missing person were caused by the application of coloured chalk or pencil. Such an objection to evidence hardly needs serious refutation. Coloured marks could only be produced by very soft chalk, and would never have the depth, intensity, or appearance of tattooing. They would be removed and obliterated by the slightest friction. The most superficial observer could not be deceived by them. Again, it may be alleged of a missing person, by one set of witnesses, that he was tattooed, and by another set that they had had casual opportunities of seeing his skin and did not observe any tattoo-marks. In such a case, the evidence given by near relatives, whose opportunities of observation are much more frequent, is more reliable than that of persons who could have had only an opportunity of seeing the bare skin on some rare occasions, and could have had no particular reason at the time for observing its condition. This, of course, becomes simply a question of credibility and accuracy of observation.

A medical man may be consulted about the removal of these marks; and when he has tried experiments on this subject he will be able to appreciate the view generally entertained of their indelibility, at least so far as the carbon-marks are concerned. Some years since the author was consulted in the following case. By an accidental discharge of gunpowder, a portion was blown into the face of a young man. After recovery from the first effects, a bluish-black tint was left on the lower part of the forehead, the nose, and the upper part of the cheeks and eyelids. He had consulted several physicians and surgeons, and, under their advice, had employed various local applications for the removal of the marks, but without result. On examining the discoloured parts a year after the accident with a magnifying-glass, it was obvious that the small particles of carbon were deeply and firmly imbedded in the cutis. Local applications to promote absorption were tried, but it was quite evident that nothing but the destruction of the cutis would remove the marks. Blistering would have no effect, as this would only remove the cuticle.

Medico-legal questions connected with the presence or absence of tattoo-marks on the skin have been hitherto confined to proof or disproof of the identity of persons charged with crime. Probably few cases in the present century have excited greater interest among the public or given rise to greater discussion than that which is known as the Tichborne case, already referred to. (*Tichborne* v. *Lushington,* C. P., 1871–2; and *Reg.* v. *Castro* or *Tichborne*, Aug. 1873.) The question involved turned entirely upon personal identity. A man calling himself Sir Roger Tichborne claimed certain estates. This led to a trial of ejectment in the Common Pleas, which extended over one hundred and three days, in which he was nonsuited, and subsequently committed for trial on numerous charges of perjury. After a trial for this offence of the unexampled duration of one hundred and eighty-eight days, the claimant was found guilty of perjury and sentenced to penal servitude.

Roger Charles Tichborne was lost at sea in April, 1854. No one who sailed in the same ship has ever been seen or heard of afterwards. At the time of his departure from England, in 1852, the real Roger had upon the inside of his left forearm certain tattoo-marks of a blue colour, representing a cross, a heart, and an anchor. These marks had been distinctly seen up to the time of his leaving England, over a period of six years, by his mother, his tutor, and a number of friends, male and female, to whom he had at intervals purposely shown them. Lord Bellew, a schoolfellow of Roger's, deposed that in 1847–8 he saw the cross, heart, and anchor on Roger's arm, and that he himself tattooed the letters 'R C T,' in addition to these symbols. The letters were made with Indian ink, and were half an inch in length. On the same day that he tattooed Roger's arm, Roger tattooed his arm with the mark of an anchor. This was done at the same time, and with the same materials. Twenty-five years had elapsed since they had thus tattooed each other, but the anchor was still there, and the witness showed his arm to the jury in confirmation of his statement. It was further proved that, as attempts had been made to bleed the real Roger in the arms, feet, and temples before he left England, there would be some cicatrices indicative of this fact. When a boy he had an issue in his arm for two years, and when this was removed and the part healed, it had left a large and deep cicatrix.

These facts were deposed to by several credible witnesses. The depression in the arm, left by this issue, was seen by them as late as nine years after its removal. Such were the facts satisfactorily proved with regard to the real heir. Twelve years after the wreck of the *Bella*, in which Roger Tichborne was lost, the defendant Castro, who was residing in Australia, first set up a claim to the estates, announcing that he was Roger, and had been saved from shipwreck. This, however, was proved to have been *after* some advertisements had appeared in the Australian papers, offering a reward for the discovery of any survivor of the *Bella*.

A large amount of evidence was received for and against the defendant's identity. It is only necessary to consider in this place the medical evidence derivable from *tattoo-marks* and *cicatrices*. There was no mark of tattooing about the person of the defendant, nor any appearance indicative of his having been tattooed. Lipscombe, his physician, had examined him and found no tattoo-marks, and, to add to the force of this evidence, the defendant himself denied that he had ever been tattooed. As to cicatrices, the evidence equally failed. Fergusson, who was a witness for him, and other surgeons, examined his arms, temple, and feet, but found no cicatrix such as would have followed bleeding. There were some scars on the feet near the ankles, but these had not been produced by incisions for bleeding in the feet. There was no scar or depression in the arm where an issue had been placed in the real Roger.

Unless we are prepared to admit that a man can be tattooed and have no knowledge of the fact, and having been thus unconsciously tattooed, that all the marks had disappeared before he saw them, it is impossible that this claimant could have been the Roger Charles Tichborne, the heir to the estates. The durability of the marks was clearly proved by Lord Bellew. So, again, with regard to cicatrices. There were none to render the story of the defendant even plausible, and, taken together with the tattoo-marks, they were in flat contradiction to his assertion. Resting upon these medical facts alone, there was sufficient to overthrow his claim and to prove to him be an impostor; but there was an accumulation of other evidence based upon the early history, education, travels, and habits of the lost heir, which clearly showed that this was a false claim. That this impostor should for so long a period have defied the law and deluded a large number of persons is in itself surprising.

Pending the Tichborne trial, a man named *Jean Luie* presented himself as a witness for the defendant, and swore that he was on board the *Bella* with the defendant, and had escaped with him from the wreck. It was, however, proved that he was a ticket-of-leave convict named Lungren, who had been repeatedly in gaol, and was recognized by several gaolers. Lungren, according to the gaol-books, had a deformity of the little finger of each hand, and certain moles were upon his back. All these were found on the pretended Jean Luie. He was tried and convicted of thus endeavouring to defeat justice by flagrant perjury.

Medical Responsibility.—The process of tattooing is not unattended with danger. Cases are recorded in which syphilis has been thus transmitted by inoculation. ('Ann. d'Hyg.,' 1855, t. 1, p. 175.) Berchon collected four cases in which the operation proved fatal by reason of the after-consequences. ('Ann. d'Hyg.,' 1870, t. 2, p. 464.)

CHAPTER 33.

WOUNDS OF THE HEAD.—CONCUSSION.—HOW DISTINGUISHED FROM INTOXICATION.—EFFUSION OF BLOOD AS A RESULT OF VIOLENCE, DISEASE, OR MENTAL EXCITEMENT.—WOUNDS OF THE FACE.—DEFORMITY AS A CONSEQUENCE OF WOUNDS OF THE FACE.—INJURIES TO THE SPINE AND SPINAL MARROW.—FRACTURES OF THE VERTEBRÆ.

THE *danger* of wounds, and their *influence in causing death*, are the two principal points to which the attention of a medical jurist must be directed.

WOUNDS OF THE HEAD.

Incised wounds, affecting the scalp, unless of great extent, rarely produce any serious effects. When the wound is contused, or accompanied by much laceration of the skin, it is highly dangerous in consequence of the tendency which the inflammatory process has to assume an erysipelatous character. The results of these wounds are, however, such as to set all general rules of prognosis at defiance. Slight punctured wounds will sometimes terminate fatally in consequence of inflammation, followed by extensive suppuration; while, on the other hand, a man may recover from a lacerated wound by which the greater part of the skin may have been stripped from the bone. There are two sources of danger in *wounds of the scalp:* 1. The access of erysipelatous inflammation. 2. Inflammation of the tendinous structures, followed or not by a process of suppuration. Either of these secondary effects may be a consequence of slight or severe wounds, and prove fatal. Neither can be regarded as an unusual result of a severe wound of the scalp, but when one or the other follows a slight injury, there is reason to suspect that the patient may have been constitutionally predisposed to the attack. Bad treatment may likewise lead to a fatal result from a wound not serious in the first instance, but the question, how far the responsibility of an aggressor would be affected by a circumstance of this nature, has been considered in another place (p. 299). Wounds of the head are dangerous in proportion as they affect the brain; and it is rare that a severe contused wound is unaccompanied by some injury to this organ. There is, however, a difficulty which a practitioner has here to contend with—namely, that it is scarcely possible to predict from *external* appearances, the degree of mischief which has been produced within. These injuries, as it is well known, are capricious in their after-effects; the slightest contusions may be attended with fatal consequences, while fractures, accompanied by great depression of bone, and an absolute loss of substance of the brain, are sometimes followed by perfect recovery. Another difficulty in the way of forming a correct opinion consists in the fact that a person may recover from the first effects of an injury, but after some days or weeks he will suddenly die; and, on examination of the body, the greater part of the brain will be found destroyed by suppuration, although no symptoms of mischief may have manifested themselves until within a few hours of death.

Concussion.—The common effect of a violent blow on the head is to produce concussion or effusion of blood, or both. Concussion is usually indicated by fainting, insensibility, or sudden death occurring immediately or soon after the application of external violence. In concussion, the symptoms come on at once, and the patient sometimes dies without any tendency to reaction manifesting itself. In the most severe form, the person drops at the very moment when struck, and dies on the spot. In other cases, he may linger in a state of insensibility for several days or weeks, and then die. In concussion, there is generally more or less vomiting. It is important to remember that neither compression nor obvious physical injury to the brain is necessary to render concussion fatal. This may be entirely dependent on shock to the nervous system. After death, no particular morbid change may be discovered in the body, or there may be merely the mark of a slight bruise on the head. The state of insensibility observed in concussion may be only apparent; a slight degree of consciousness may be retained. A blow on the skull may cause death by leading to abscess in the brain, although there may be no fracture or other physical injury. A case of this kind proving fatal in about a week is reported. ('Lancet,' 1873, i. p. 697.)

Inflammation may follow the primary shock from concussion, suppuration may take place, and the patient die after the lapse of several weeks, or even months. It is necessary in a medico-legal point of view to notice that a person may move about and occupy himself, while apparently convalescent, for a week or ten days after recovery from the first shock, and then suddenly be seized with fatal symptoms and die. This apparent recovery leads to the common suppositions, that death must have been produced by some intervening cause, and not by the original violence to the head—a point generally urged in the defence of such cases. When the inflammation that follows concussion is of a chronic character, the person may suffer from pain in the head and vomiting, and die after the lapse of weeks, months, or even years. Concussion may sometimes take place as a consequence of a violent fall on the feet, in which case the head receives a shock through the medium of the spinal column. The skull may be thereby extensively fractured at the base, and the brain may be even shattered by such a fall. This was the cause of death in the case of the *Duke of Orleans*, the son of Louis Philippe.

In *Allen* v. *The Chester Ry. Co.* (Com. Pleas, Feb. 1857), the plaintiff claimed damages for an injury caused by a railway collision. The evidence showed that the plaintiff received a blow on the head. There were no immediate effects; but in two days he suffered from lightness of the head and other symptoms, attributed by his medical attendant to *concussion* of the brain, as a result of the accident. Subsequently there were symptoms of injury to the spine. There was pain in the course of the spine, partial paralysis of the bladder, rectum, and legs, with loss of memory. The medical witnesses for the plaintiff attributed these symptoms to a blow received by him at the base of the skull. The defendants contended that, if these were the results of concussion of the brain, they ought to have manifested themselves immediately on the occurrence of the accident; and this view was to some extent supported by the evidence of experienced surgeons. In substance, however, the medical evidence on the two sides was not conflicting. Concussion of the brain, as it is ordinarily known to surgeons, is generally attended with some *immediate* symptoms; but the witnesses for the defence properly admitted that 'a concussion of the brain (and spine?), attended with apparently slight symptoms at first, might, under peculiar circumstances, be followed by serious symptoms.' As no other cause could be assigned for the symptoms, this was practically admitting that the plaintiff had suffered from the injury, the degree being simply a question for the jury. They returned a verdict for the plaintiff.

Concussion distinguished from Intoxication.—The symptoms under which a wounded person is labouring may be sometimes attributed to *intoxication*, and a medical witness may be asked what difference exists between this state and that of concussion. The history of the case will, in general, suffice to establish a distinction, but this cannot always be obtained. It is commonly said that the odour of the breath will enable a surgeon to detect intoxication; but it is obvious that a man may meet with concussion after having drunk liquor insufficient to cause intoxication, or concussion may take place while he is intoxicated—a combination which frequently occurs. Under such circumstances we must wait for time to develop the real nature of the case. Concussion may be so slight as sometimes closely to resemble intoxication, and, from the absence of all marks of violence to the head and the existence of a spirituous odour in the breath, the medical examiner might be easily deceived. If there be no perceptible odour in the breath, the presumption is that the symptoms are *not* due to intoxication. On the other hand, intoxication may be so great as to give rise to the apprehension of fatal consequences, and the coexistence of a mark of violence on the head might lead to error in the formation of an opinion. What is the line of conduct to be pursued on such occasions? The examiner should weigh all the circumstances, and if there be one cause for the symptoms more probable than another, he should adopt it; if there be any doubt, this should be stated to the court. This mistake is still frequently made, and a person in a state of insensibility from violence or disease has his death accelerated by confinement in a cell as a drunken person, when it subsequently transpires that he has not been drinking, and that he really requires medical aid. In the metropolis this aid is now sought by the police.

There is nothing in the state of the brain in a dead body which will enable a practitioner to distinguish whether concussion or intoxication had existed and had been the cause of the symptoms. The vessels may be congested in both cases. The discovery of an alcoholic liquid in the stomach might lead to a presumption that the deceased had been intoxicated, while marks of violence on the head might favour the view that he had suffered from concussion. When both conditions are found, the examination of the body cannot lead to a solution of the question. The answer must then depend on the special circumstances proved, and, if procurable, on the nature of the symptoms preceding death. It is to be feared that medical witnesses are not sufficiently careful on these occasions to determine whether there are signs of intoxication about an injured person. Subsequent proceedings may render this a material part of the injury.

The distinction of apoplexy from drunkenness involves greater difficulties. In these cases we have to deal with the true diagnosis of alcoholic or narcotic poisoning (see Opium, p. 163, *ante*). Jackson has directed attention to this medical question in a case reported in the 'Med. Times and Gaz.,' 1871, i. p. 360. Some instructive cases, in reference to this complication of wounds, have been published by Tardieu. (See 'Lond. Med. Gaz.,' vol. xliv. p. 347.)

Extravasation or Effusion of Blood.—A blow on the head may destroy life by causing an effusion of blood either on the surface or in the substance of the brain. In pugilistic combats, when a person is thus struck, he commonly falls, and death may take place in a few minutes. On inspection, blood may be found effused either at the base or in the ventricles of the brain, and the question will present itself, Did the injury which caused death arise from *a blow or a fall?* A heavy blow on the head may cause fatal effusion of blood, but on these occasions the effusion commonly arises from the violent concussion which the injured person sustains by the fall. A medical witness will therefore in general be compelled to admit that the fatal effusion might have taken place either from a blow or a fall. If the fall has resulted from accident, and not from a blow, this will, of course, absolve the accused from responsibility for the fatal results. This subject has important applications in legal medicine, for this is one of the most common causes of death from injuries to the head, and there are many cases of this description tried. Effusion may occur from violence with or without fracture, and it may take place without being accompanied by any external marks of injury.

In case of injury to the head proving fatal by *effusion* of blood on the brain, a person may recover from the first effects of the violence and apparently be going on well, when he will suddenly become worse and die. Effusion takes place slowly at first; it may be arrested by the effects of stupor from concussion, by a portion of the blood coagulating around the ruptured orifices of the vessels, or by some other mechanical impediment to its escape; but after a longer or shorter period, especially if the person be excited or disturbed, the bleeding will recur and destroy life by producing compression of the brain. How many hours or days are required in order that such an increased effusion should take place after an accident, it is impossible to say; but in severe cases, it is generally observed to follow the injury within a short time. Astley Cooper has related the case of a gentleman who was thrown out of a chaise, and fell upon his head with such violence as to stun him in the first instance. After a short time he recovered his senses, and felt so much better that he entered the chaise again, and was driven to his father's house by a companion. He attempted to pass off the accident as of a trivial nature, but he soon began to feel heavy and drowsy, so that he was obliged to go to bed. His symptoms became more alarming, and he died in about an hour, as it afterwards appeared, from effusion of blood on the brain. When the brain has sustained laceration from violence, in addition to insensibility, convulsions are frequently observed.

Effusion of Blood from Disease or Violence.—Blood may be found effused in various situations within the interior of the skull, and the cause of the effusion may be either disease or violence. The skill of a medical jurist is often required to determine which of these causes is the more probable, as where, for instance, a pugilist has died, after having received severe injuries to the head, and his adversary is tried on a charge of manslaughter. On these occasions it is often urged, in the defence, that the bleeding might have arisen either from the diseased state of the vessels of the brain, or, if the evidence render it probable that the blow was the cause, that the effects of the blow were aggravated by a diseased condition of the vessels, or by the excitement into which the deceased was thrown, either from the effects of intoxication or passion. (See case of *Reg.* v. *Saxon*, p. 292, *ante.*) When the brain is not lacerated by violence, the blood is effused either on the surface of the hemispheres, between the membranes, or at the base. When the effusion is caused by violence, the effused blood is not always found under the spot where the blow was inflicted, but occasionally by counter-stroke on the surface of the brain, directly opposite to it—a case which a medical witness has frequently been required to explain on trials, and which depends on the same cause as fracture by counter-stroke, *i.e.* on a separation of parts (laceration of the brain, effusion of blood, or even fracture of the bones) at the point of the skull directly opposite to that which sustains the violence. Thus fracture of the base of the skull is frequently the result of severe violence applied to the top of the head (vertex). Effusions of blood from a diseased state of the vessels more commonly take place on the substance of the brain, but they sometimes occur on the surface of the organ as a result of mere excitement or over-exertion of the muscular powers. A diseased condition of the vessels, and probably a softening of the substance of the brain, will, on these occasions, be apparent on inspection.

If the effusion depend on *disease*, the arteries around may be found diseased, or the brain itself may be found softened and disorganized.

The state of the brain and its vessels should be closely examined in all cases of alleged violence, since hæmorrhage may take place either from excitement or heavy blows, wherever this diseased condition exists. It has occasionally happened, especially in old persons, that the person has dropped down dead without a blow being struck, and that death has been wrongly imputed to violence. Cerebral hæmorrhage from disease rarely occurs in persons under forty years of age. Frequent intemperance and violent passion may, however, easily create a tendency to it in younger persons. As an effect of violence it may take place in persons of all ages, but, when the marks of violence are slight, a witness must exercise great caution before he alleges that the effusion was produced by a blow, especially when it is found that the deceased was of intemperate habits.

As a summary of these remarks, we may say that, in effusions of blood from *violence,* the blood generally issues from a vessel which is plainly seen to be torn, as the middle artery of the brain, or the lateral sinus. The effused blood is commonly found on the surface of the brain, and not in its substance, unless the organ is lacerated. When situate between the dura mater (outer membrane) and the skull, but especially when immediately below the seat of violence or directly opposite to it by counter-stroke, this is strong evidence, *cæteris paribus,* that it has proceeded from a blow. When there is a fracture of the skull, the presumption of the extravasation being due to violence is great; because this is not only a sufficient, but an obvious cause, while the idea of its having proceeded from disease only is remote and speculative. When, besides these conditions, there is no remarkable congestion of the brain in other spots, when the substance of the brain is firm, and the vessels are to all appearance free from disease, we have the strongest reason to believe that the effusion must have been due to violence, and to no other cause whatever.

The evidence given on some trials, when the main question has turned upon the *cause* of an effusion of blood on the brain, in the case of a person who has sustained violent injuries to the head, has rather tended to reflect disgrace on medical science. It has been made to appear from the mouth of the medical witness, either directly or by implication, that no sort of mechanical violence applied to the head of a man in a state of drunkenness or passion—of one whose cerebral vessels were probably diseased—could have had any effect in producing a fatal extravasation found in the head after death. In spite of an individual having received a violent blow with a bludgeon, sufficient to have killed a stout and vigorous man, or of his having been thrown with considerable force with his head against a stone floor, an unqualified admission is often made, that excitement alone, or drunkenness alone, would account for the effusion without reference to the blow. In putting the most favourable construction upon these cases, when we have clear evidence of great violence having been used to the head, with the presence of the usual post-mortem appearances, our opinion should be that the excitement or drunkenness might have predisposed to, but was not the immediate cause of, the cerebral hæmorrhage. A mere inspection of the body does not always lead to the discovery of the cause of an effusion on the brain. The violence producing an effusion of blood may have been slight, and, unless attention is particularly directed to the subject, it may be overlooked. The condition of the effused blood should be accurately noticed, in order to determine whether it presents any marks indicative of its being recent or of old standing.

Spontaneous effusions, or effusions from disease, are not easily distinguished from those which are the result of violence to the head. Wilks has pointed out that in most instances of *severe* injury attended with effusion of blood, the structure of the brain is found bruised. In meningeal apoplexy (apoplexy of the membrane) the source of the blood is a vein of the pia mater, or inner membrane, and sometimes a large arterial trunk. The difficulty chiefly arises in those cases in which effusion is found after slight violence, and there is, at the same time, disease of the blood-vessels of the brain. Wilks gives the results of several inspections in which effusion was owing to disease, to violence, and to a mixed condition. (See 'Guy's Hosp. Rep.,' 1859, p. 120.)

Effusion of Blood from Excitement.—When engaged in the investigation of these cases, it is always a fair matter of inquiry whether the *violence*, upon the evidence, was not of itself sufficiently great to account for the effusion without the supposition of coexisting disease or excitement. Admitting that the rupture of a blood-vessel, and the extensive effusion of blood on the brain, may take place from simple *excitement* and passion, yet this is an event comparatively rare, at least in the young and healthy, while nothing is more common than that these results should follow violent injuries to the head, whatever the age or condition of the person. (See case of *Reg.* v. *Saxon*, p. 292, *ante.*) A medical witness should remember that on these occasions, if he is unable to say positively whether the effusion was due to the excitement or the blows, he will satisfy the court if he only states clearly that which is, in his own mind, the more probable cause of death; and, by weighing all the circumstances of the case beforehand, he will rarely fail to find that one cause was more probable than the other. Thus, if a man, excited by passion and intoxication, is struck on the head, and the blow is slight—such as an unaffected person would probably have sustained without injury—yet in this case insensibility and death follow, and, on examination, a quantity of blood is found effused in the substance of the brain: can it be a matter of doubt with the practitioner that the effusion was chiefly due to the excitement under which the deceased was labouring? To take a converse instance—a man engaged in a personal conflict with another is struck most violently on the head, or falls with great force on this part of the body; on an inspection it is found that death has arisen from effusion of blood on the surface of the brain, and it would be no unexpected consequence of the violence inflicted, that a similar appearance should be met with in an individual calm and unexcited: can the practitioner hesitate to say, under these circumstances, that the blow would satisfactorily account for the effusion, without reference to any coexisting causes of excitement?

In these criminal investigations, when a witness is examined in chief, he asserts, perhaps, that the effusion of blood was owing to a blow inflicted on the head. The counsel who cross-examines him, then puts the leading question, whether vessels may not be ruptured by excitement; he answers, without any qualification, in the affirmative, and thus produces an impression on the minds of the jury that excitement may have caused the rupture of the vessel in the particular case on which he is being examined. This is, of course, the sort of answer which a prisoner's counsel wishes to extract from a witness; and the effect produced by it on the court is not always removed, even by a careful re-examination. The counsel for the defence is well aware that, in a case of this description, his only chance of obtaining an acquittal is to throw a degree of doubt on the medical evidence, and to render it probable to a jury that the death of the deceased person was due to some other cause than the blow inflicted by the prisoner. As leading questions are allowed to be put to any extent in a cross-examination, the answer in the monosyllable 'yes' or 'no' generally carries with it much more than a medical witness intends. A medical witness should remember that he is sworn to state the *whole* truth. A qualified answer should be given to what is really a general question; and, supposing his opinion to be already formed on the subject on which his evidence is required, he should not, unless it be strictly consistent with his own views, allow his answer to a *general* question to be made applicable to a *particular* case. If, then, asked in cross-examination whether vessels might not be ruptured and blood extravasated by mere *excitement*, he should answer that such an effect might undoubtedly follow; but that it was his opinion—and I am here supposing that his opinion has been founded upon a deliberate examination of all the *medical* facts—that excitement was *not* the cause of rupture and extravasation in the case in question. A witness has a right to insist that his evidence shall pass to the jury without having any designed ambiguity attached to it.

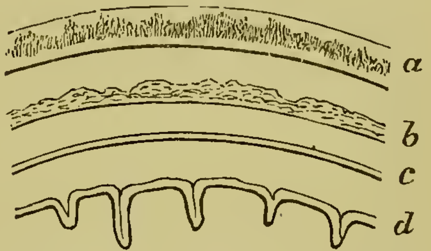
Date of Effusions.—Recent effusions of blood are recognized by their red colour, and the consistency and appearance of the clot, or coagulum. After some days the clots acquire a chocolate or brown colour, and this passes gradually into an ochreous tint, which may be met with in from twelve to twenty-five days after the violence. ('Guy's Hosp. Rep.,' 1859, p. 122.) Coagula of effused blood also undergo changes in structure and consistency; when old, they are firmer, and there is much lymph, which is sometimes disposed in membranous layers of a fibrous structure, and these are adherent to the dura mater and the brain. The surface of this organ sometimes presents a mark indicative of pressure. When a medical man is required to give an opinion of the *date* of an effusion found on the brain, great caution is required. He may not be able to fix the precise date, but it may be in his power to say whether the blood has been effused for a few days, or for weeks, or months.

When a blow on the head is of a heavy bruising kind, the whole substance of the skull may be fractured without a division of the skin.

There is one remarkable circumstance connected with fractures accompanied by depression of bone, which here requires to be mentioned—namely, that the person has been sensible so long as the foreign substance which produced the fracture and depression remained wedged in the brain, and that insensibility and other fatal symptoms began to manifest themselves only after its removal. This being admitted, it may be urged in defence that death was really caused by medical interference. But it is a sufficient answer to state that the wounded person must have died from inflammation of the brain if the foreign body had been allowed to remain; and that it is consistent with the soundest principles of practice to remove all such foreign substances without delay. In fractures of the skull with depression, it may become a question whether the surgeon raised the depressed portion of bone so soon as he ought to have done.

In the description of injuries of the head, it is impossible to avoid the use of terms with which members of the legal profession are not likely to be acquainted. In giving evidence upon the situation of wounds, of the effusion of blood, and the effects of fractures, medical witnesses are often compelled to make use of anatomical terms, and are not always successful in explaining them. With the view of removing this difficulty, and supplying, to some extent, the means of following the evidence of a witness in his description of injuries to the head and its contents, a diagrammatic engraving, representing the relative position of the membranes of the brain, is annexed.

Fig. 48.



The skull, with its outer and inner table, and the three coverings of the brain (membranes), seen in section.

Fig. 48 represents a section of the bones of the skull, with the three membranes which cover the brain. (*a*) Section of the skull-bones, with the outer and inner tables, and the intermediate cellular structure or diploë, indicated by the dark shading; the scalp, or skin of the skull, which covers the outer table, is not represented. (*b*) The dura mater, or outer membrane of the brain; it is thick and fibrous, closely adherent to the inside of the inner table of the skull, but smooth on the side towards the brain. (*c*) The arachnoid membrane, so named from its delicate web-like structure, forms a closed sac, covering the dura mater—to the inner surface of which it gives its glistening aspect—and also the pia mater on the surface of the brain, which it closely covers, without dipping into the convolutions. (*d*) The pia mater—the membrane which immediately invests the substance of the brain and dips into all the convolutions. It contains the blood-vessels which nourish the hemispheres of the brain. These membranes are, for distinctness, represented as being separated from each other, but they are naturally in close proximity, and the rough side of the dura mater is closely adherent to the inside of the skull (calvarium). The ordinary seats of the effusion of blood from violence are between the dura mater and inner table of the skull, and between the pia mater and the surface, or into the substance of the brain.

In reference to persons found dead with severe injuries to the head, attended with fracture and effusion of blood on the brain, a medical man may be required to say whether such an amount of violence is or is not consistent with the retention of muscular exertion, and power of locomotion by the deceased. For instance, a man may fall from a height, and produce a severe compound fracture of the skull. He may, nevertheless, be able to rise and walk some distance before he falls dead. Under these circumstances there might be a strong disposition to assert that the deceased must have been murdered—the injuries being such that they could not have been produced by himself, there being at the same time no weapon near, and no elevated spot from which he could have fallen. The discovery, after death, of severe injury to the head, with great effusion of blood on the brain, must not, however, lead a surgeon to suppose that the person who sustained the violence had been *immediately* incapacitated. There are various cases recorded which show that a power to move has been retained under conditions which might be supposed to render a person incapable of moving from the spot. Full allowance must be made on these occasions for the possible exercise of locomotion by the deceased. Although a large quantity of blood may be found after death pressing on the substance of the brain, it does not follow that this effusion and pressure were the immediate results of the violence. (See case of *Reg.* v. *Saxon*, p. 292.)

The importance of these observations will be further seen by the following case. A man was found dead in a stable with a severe fracture of the temporal bone, which had caused a rupture of the middle artery of the brain. A companion was accused of having murdered him, but he alleged that the deceased had fallen from his horse the day before, and had thus met with the accident. It appeared, however, that, after the fall, the deceased had gone into a public-house before he returned to the stables, and had remained there some time drinking. The question respecting the guilt of the accused party rested upon the fact whether, after such an extensive fracture of the skull with extravasation of blood, it was possible for a man to do what the prisoner had represented the deceased to have done. Wallace very properly gave a qualified opinion; he said it was improbable, but not impossible, that, after receiving such an injury, the deceased could have walked into and drunk at a public-house. The extravasation was here the immediate cause of death, and probably this did not take place to the full extent, except as a consequence of the excitement from drinking.

Wounds of the Brain.—Wounds of the brain, even when slight, sometimes prove instantaneously mortal, while in other cases recoveries take place from contused or punctured wounds of this organ, contrary to all expectation. When a person survives the first effects of the injury, there are two sources of danger which await him: 1. The production of so-called fungus from the exposed portion of the brain. 2. Inflammation and its consequences. The process of inflammation, it must be remembered, is very slowly established in this organ; it may not manifest itself until from three to ten weeks after the injury. In one remarkable case, where a child was accidentally shot through the brain, the ball having traversed both hemispheres, no symptoms of cerebral inflammation manifested themselves for twenty-six days. The child died on the twenty-ninth day. ('Lond. Med. Gaz.,' vol. xxxix. p. 41.)

Wounds of the Face.—When wounds of the face are of any extent, they are usually followed by great deformity; and when they penetrate the cavities in which the organs of the senses are situated, they often prove fatal, either by involving the brain and its membranes, or by giving rise to inflammation of this organ. Wounds of the eyebrows are not of so simple a nature as might at first sight be supposed. Besides being attended with deformity when they heal, they are liable, during the process of healing, to cause serious disorders of the neighbouring parts. Amaurosis and neuralgia are recorded among the secondary and not unusual consequences of such wounds, when the supra-orbitar nerve has become implicated. Under certain conditions of the body, there may be inflammation of the parts within the orbit, extending to the membranes of the brain, and proving fatal by leading to the formation of pus within that organ. Amaurosis in the right eye has been known to occur from a contused wound, not of a violent nature, on the right eyebrow. Wounds apparently confined to the external parts of the face frequently conceal deep-seated mischief. A sharp instrument penetrating the eyelid, and passing upwards with force, will produce fracture of the orbital plate of the frontal bone, which is very thin, and even injure the brain beyond.

Deformity as a Consequence of Wounds of the Face.—Wounds of the face, when at all extensive, are always followed, in healing, by greater or less *deformity*. A medical witness may, perhaps, find these questions put to him in relation to them—Is the wound likely to be attended with deformity? Could such a wound of the face heal without deformity? or, Could the deformity, if it exist, have been produced by any other cause than the wound? These questions are of importance. A person may allege that he was severely wounded in the face, when the medical witness may find no trace of such a wound as that described. Again, a person may seek damages from another in a civil action, alleging that a particular deformity was produced by a wound, when the medical witness may be able to trace its origin to disease, or to some accidental cause.

INJURIES TO THE SPINE.

The spinal marrow is liable to *concussion* from blows, to compression from fracture of the vertebræ or the effusion of blood, with all the secondary consequences attending such accidents. Concussion of the spinal marrow commonly produces paralysis, affecting the bladder, rectum, or lower limbs. These symptoms may not appear at once, but come on after some hours or days. After death no traces of mechanical injury may be discovered. Blows on the spine, unattended with fracture or dislocation, may be followed by inflammation and softening of the spinal marrow. A slight injury has thus been known to cause death, by giving rise to inflammation of the spinal marrow. This organ is also liable to compression from slight causes, and death may occur from paralysis of the nerves of respiration.

Fractures of the Vertebræ.—These fractures are generally attended with displacement, and thus produce compression of the spinal marrow. They are the more rapidly fatal in proportion as the injury is high up in the vertebral column. The whole of the body becomes paralysed below the seat of injury, as a result of the compression of the spinal marrow. If the seat of compression is above the fourth cervical vertebra, death is commonly immediate; asphyxia then results from paralysis of the nerves which supply the diaphragm, and which are necessary to respiration. In falls on the summit of the head from a height, it sometimes happens not only that the skull is extensively fractured, but that the dentiform process of the second vertebra is broken off, owing to the head being doubled under the body. This injury to the second vertebra may be the cause of death. From a case related by Phillips, it would appear that this accident is not always attended with fatal compression of the spinal marrow. ('Edin. Med. and Surg. Jour.,' Jan. 1838, p. 265.) In one instance the person survived fifteen months (Ibid., Oct. 1845, p. 527); and in another, in which the fracture was caused by the patient turning in bed while his head was pressed on the pillow, death did not take place for *sixteen* months. On several criminal trials, this injury was proved to have been the cause of death; and in a case tried at Glasgow (*Rex* v. *Reid*, 1835), it became a material question, how far such a fracture might result from disease. It may happen that caries of the bone, or disease of the transverse ligament, will cause a separation of the dentiform process from the second cervical vertebra. The state of the bone in these alleged fatal accidents should, therefore, be closely examined. A slight cause may sometimes produce severe and fatal injury to the neck. A lunatic in a private asylum suddenly threw her head back, in order to avoid taking some food that was offered to her; and she fell dead, evidently from the compression produced by a sudden displacement of the dentiform process of the second vertebra. A woman died suddenly a month after her confinement; she had been suckling her child at one o'clock in the morning, and at four she was found dead. The viscera of the abdomen, chest, and head were carefully examined, without the discovery of any morbid appearance to account for death, when, as the brain was being returned into the skull, one of the inspectors noticed a projection at the foramen magnum. On further examination, the dentiform process of the second vertebra was found to have been displaced, and this had so injured the spinal marrow as to destroy life. ('Lond. Med. Gaz.,' vol. iii. p. 582.) It is not stated whether the bone was in a healthy or diseased condition. In fractures of the vertebræ, a person is generally so disabled, whatever may be the situation of the fracture, that he cannot walk or exert himself.

Injuries to the spine and its contents are generally the result of falls or blows, either on the head or the lower part of the column. The secondary consequences of these injuries are sometimes so insidious as to disarm suspicion, and death may take place quite unexpectedly some weeks after the accident. Spicula of bone, separated by fractures, may remain adherent for some time; and, by a sudden turn of the head, be forced off, and destroy life by penetrating the spinal marrow, at a long period after the infliction of the injury. This has been known to happen in fractures involving the margin of the foramen magnum, and in such cases death is immediate. The *spinal marrow* has been in some instances wounded in its upper part by sharp-pointed instruments introduced between the vertebræ. Death is an instantaneous result when the wound is above the third cervical vertebra: there is no part of the spine where a weapon can so easily penetrate as this, especially if the neck be slightly bent forward. The external wound thus made may be very small, and if produced with any obliquity by drawing aside the skin, it might be easily overlooked, or it might be set down as superficial.

CHAPTER 34.

WOUNDS OF THE CHEST.—WOUNDS AND RUPTURES OF THE LUNGS AND HEART. —WOUNDS OF LARGE BLOOD-VESSELS. — WOUNDS AND RUPTURES OF THE DIAPHRAGM. — DIRECTION OF WOUNDS OF THE CHEST. — WOUNDS OF THE ABDOMEN.—DEATH FROM BLOWS ON THE CAVITY.—RUPTURES OF THE LIVER, GALL-BLADDER, SPLEEN, KIDNEYS, INTESTINES, STOMACH, AND URINARY BLADDER.—WOUNDS OF THE GENITAL ORGANS.

Wounds of the Chest.—Wounds of the chest have been divided into those which are confined to walls and those which penetrate the cavity. Incised or punctured wounds of the walls of the chest are rarely followed by dangerous consequences. The bleeding is not considerable, and is generally arrested without much difficulty. They heal either by adhesion or suppuration, and, unless their effects are aggravated by incidental circumstances, the person recovers. Contusions or contused wounds of the chest are, however, far more dangerous, and the danger is in a ratio to the degree of violence used. Such injuries, when severe, are ordinarily accompanied by fractures of the ribs or sternum; by a rupture of the viscera within the cavity, including the diaphragm; by profuse bleeding; or, as an after-effect, by inflammation of the lungs, with or without suppuration. Fractures of the ribs are dangerous for several reasons: the bones may be splintered and driven inwards, thereby wounding the lungs and causing hæmorrhage, or leading to inflammation of the pleura or lungs. The intercostal arteries may also be wounded. In fractures of the upper ribs, the prognosis is less favourable than in those of the lower, because commonly a much greater degree of violence is required to produce the fracture. A simple fracture of the sternum, or chest-bone, without displacement of the bone, is rarely attended with danger, unless the concussion has at the same time produced mischief internally, which will be known by the symptoms. When, however, the bone is depressed as well as fractured, the viscera behind may be mortally injured. In a case of depressed fracture of the sternum, the person died after the lapse of thirteen days; and on inspection it was found that the fractured portion of bone had produced a transverse wound of the heart about an inch in length. The cavities of the organ had not been penetrated, but the piece of bone was exactly adapted to the depression produced by it on the parietes. (Devergie, 'Méd. Lég.,' t. 2, p. 243.) A witness will frequently be required to take into consideration the effects of contusions on the thorax, with or without fracture, in cases of death from pugilistic combats, which formerly gave rise to numerous trials on charges of manslaughter. Wounds penetrating into the cavity of the chest are generally dangerous, even when slight, in consequence of the numerous accidents with which they are liable to be complicated. In these wounds, the lungs are most commonly injured; but, according to the direction of the weapon, the heart, or the great vessels connected with it, as well as the gullet or thoracic duct, may share in the mischief.

Wounds of the Lungs.—The immediate cause of danger from wounds of these organs is hæmorrhage, which is profuse in proportion to the depth of the wound and the size of the vessels wounded. Should the weapon divide any of the trunks of the pulmonary veins, the individual may speedily sink. The degree of hæmorrhage cannot be determined by the quantity of blood which escapes from the wound; for it may flow internally, and collect within the cavity of the pleura, impeding respiration. This is especially to be feared when the external orifice of the wound is small and oblique, and one of the intercostal arteries has been touched by the weapon. A wound of the lung is generally known, among other symptoms, by the frothiness and florid colour of the blood which issues from the orifice, as well as by the expectoration of blood. The lungs may sustain serious injury from a blow or fall, and yet there may be no external marks of violence or symptoms indicative of danger for some hours. When death occurs during the convalescence of a person who has survived the first effects of a penetrating wound of the chest, the surgeon should observe whether it may not have been caused either by imprudence on the part of the patient, or by abuse of regimen, or other misconduct; for circumstances of this nature may be occasionally treated as mitigatory on the trial of an assailant. In all cases where a person is progressing to recovery, a relaxation of regimen should be made with great circumspection. Too much nourishment, too frequent talking, or any exertion, are circumstances that may cause a renewal of the bleeding and extravasation.

Wounds of the Heart.—Wounds of the heart are among the most fatal of penetrating wounds of the chest. It was formerly considered that all wounds of this organ were necessarily and *instantly* mortal. Undoubtedly, when either of the cavities is laid open to a large extent, the bleeding is so profuse on the withdrawal of the weapon, that death must be immediate. But when the wound is small, and penetrates into the cavities of the heart obliquely, life may be prolonged for a considerable period; and cases are on record in which it is probable that such wounds would have healed, and the patients have finally recovered, but for the supervention of other diseases which destroy life.

It was the opinion of Dupuytren that these injuries were not necessarily fatal, although, with perhaps one exception, there is no case on record in which a person has recovered from a penetrating wound of the cavities of the heart. (' Edin. Med. and Surg. Jour.,' Oct. 1844, 557; also 'Ann. d'Hyg.,' 1846, t. 1, p. 212.) There are few, probably, who will be inclined to consider them curable; a remote possibility of simple wounds healing, and of the patient recovering, may be admitted, but until some clear instances of recovery from penetrating wounds of the cavities are reported, the majority of practitioners will continue to look upon them as fatal. From a series of cases collected by Ollivier and Sanson, it appears that out of twenty-nine instances of penetrating wounds of the heart, only two proved fatal within forty-eight hours. In the others death took place at the varying periods of from four to twenty-eight days after the infliction of the wound. (Devergie, 'Méd. Lég.,' t. 2, p. 253.) These differences in the time at which death occurs, as well as the fact that wounds of the heart do not instantly destroy life, have been ascribed to the peculiar disposition of the muscular fibres of the organ, and to the manner in which they are penetrated by a weapon. It appears from the observations of Ollivier and others, that the right cavities of the heart are more frequently wounded than the left, and of these the right ventricle is most commonly the seat of injury. Out of fifty-four cases of wounds of this organ, twenty-nine were situated in the right ventricle, twelve in the left ventricle, nine in the two ventricles, three in the right auricle, and one in the left auricle. These differences are readily accounted for by the relative situation of the cavities. It appears also that wounds of the right ventricle are not only the most frequent, but of all others they are the most rapidly fatal. It is considered that the suddenness of death in severe wounds of the cavities of this organ is to be ascribed, not merely to the loss of blood, but to the degree of compression which the heart experiences from that which escapes into the bag of the pericardium. In reference to the direction of penetrating wounds of the chest, it may be proper to state that the base of the heart corresponds to the upper margin of the third rib on the left side; and the apex to the lower margin of the fifth rib on the same side.

A penetrating wound of the heart was formerly considered to be instantaneously mortal, and the usual medical opinion at coroners' inquests was that a person so wounded must have dropped down dead on the spot. More accurate observations have, however, shown that this is an erroneous, and in medico-legal practice, a highly dangerous doctrine. The *Duc de Berri*, who was murdered in Paris in 1820, survived eight hours after having received a wound of the left ventricle. Other and more remarkable instances of survivorship have been recorded; and it may be stated that, although, in a surgical view, a question of this kind is of little importance, the case is very different in legal medicine. Upon it may depend the decision of questions relative to suicide, murder, or justifiable homicide. Watson met with a case in which a man who had been stabbed in the right ventricle ran *eighteen yards* after having received the wound. He then fell, but was not again able to rise; he died in six hours. On dissection, it was found that a punctured wound had extended into the right ventricle in an obliquely transverse direction, dividing in its course the coronary artery. The pericardium was nearly filled with blood. When the cavities of the heart, especially the auricles, are extensively laid open, death is likely to be an immediate result; but persons who have sustained wounds of this organ have frequently lived sufficiently long to exercise a power of volition and locomotion. In reference to penetrating wounds (stabs), little or no blood probably escapes from the heart in the first instance, but it may afterwards ooze gently, or suddenly burst out in fatal quantity. It must not, therefore, be supposed, when a person is found dead with a wound of the heart, attended with abundant hæmorrhage, either that the flow of blood took place in an instant, or that the person died immediately and was utterly incapable of exercising any voluntary power. Boileau met with a penetrating wound of the heart in a soldier, accidentally inflicted with a knife. The man did not think it serious, but laughingly ascended fifteen steps, and commenced to run to the hospital, a distance of two hundred yards; then fell, and died in five minutes. The pericardium, or bag of the heart, was found full of blood. The knife had entered the front surface of the right ventricle, pierced the septum, and passed out through the left ventricle near the apex. ('Lancet,' 1879, i. p. 560.) In 1879, a boy was admitted into Guy's Hospital with a bayonet-wound which had penetrated through the front wall of the right ventricle, which was transfixed. The bayonet had then pierced the septum, and entered the left ventricle. It pierced the mitral valve also, and entered the left auricle. The boy survived for forty-two hours, but was mostly in an unconscious state.

Minute wounds of the chest in the region of the heart are sometimes made with the intention of destroying the lives of infants or children. A woman was committed for trial (C. C. C., Jan. 1877) under the following circumstances. She was charged with endangering the life of her infant, three months old, by thrusting a needle into its side between two ribs and near the heart. A surgeon was called to the child, and he extracted a long needle from the chest. In his opinion it could not have come there by any accident, and force must have been used to push it in. This woman failed in her attempt at murder by her ignorance of the situation of the heart. Strange as it may appear, a fatal wound of this organ by a needle may be the result of accident. The following case, communicated by May, of Newcastle-upon-Tyne, occurred under his observation in 1876. A mother was clasping to her bosom her child, two years of age, forgetting that she had just placed in her dress a needle, two inches long, with which she had been sewing. The child screamed: she observed part of a needle with thread fall to the ground, and on removing the child's clothes, there was a red spot near the nipple, but no trace of blood. May could find no trace of the broken needle, but considered that about an inch and a half had been broken off and was imbedded in the substance of the heart. There is no doubt that this accidental wound was the cause of death.

The heart is liable to be *ruptured* either from disease or accident. In the latter case, the organ generally gives way towards the base, and through one of its cavities on the right side. Hope asserted that in ruptures from natural causes, it is the left side of the heart, and particularly the left ventricle, in which a rupture is most frequently found. The symptoms are sudden pain, collapse, cramps, cold extremities, and rapid death. According to the circumstances under which they occur, cases of rupture from disease may excite a suspicion of death from violence. Sometimes the substance of the heart may be found to have undergone fatty degeneration. As a medico-legal subject, it is worthy of note that when this alarming accident proceeds from blows or falls, it is not always accompanied by marks of external violence, or any fracture or other visible injury to the exterior of the chest. A girl, æt. 5, was knocked down and run over by a cart. When brought to the hospital she was quite dead, and there was no mark of injury upon any part of the body. On inspection, the pericardium was found to be full of blood, which had issued from a transverse rent across the apex of the heart. Both ventricles were laid open; the muscular substance was torn to a greater extent than the pericardium. The ribs were not fractured. The *natural* causes of rupture of the heart are violent mental emotions, such as anger, fright, terror, paroxysms of passion, sudden or excessive muscular efforts, or violent physical exertions in constrained positions. The heart, like any other muscle, may also give way from its own powerful contraction. When the heart is in a diseased condition, any slight causes of excitement are sufficient to produce rupture and sudden death. The mere exercise of walking rapidly or running may thus give rise to fatal consequences, but death may take place quite suddenly while the person is at rest. A man, æt. 36, who had had no previous symptoms of illness, died suddenly during the night. On inspection, a rent, half an inch in length, was found in the right ventricle of his heart. The walls of the ventricle were soft and thin. There was a large effusion of blood, which accounted for death. ('Lancet,' 1872, vol. ii. p. 41.) Another case of sudden death from rupture of the left ventricle is recorded in the same journal. (Ibid., 1872, vol. ii. p. 524.) In both cases sickness was an early symptom.

Wounds of Arteries and Veins.—Wounds of the large arterial and venous trunks around the heart must be considered as mortal: death is generally speedy from the sudden and profuse bleeding which attends them. With regard to these fatal effusions of blood within the chest, as well as in the other great cavities, it may be mentioned that, from whatever vessel or vessels the blood may have issued, it is not commonly found coagulated to any extent. The greater part of it generally preserves the liquid state, and it is rare that so much as one-half of the quantity effused is met with in the form of coagulum. These effusions of blood in the chest may be sometimes traced to wounds of the intercostal and the internal mammary arteries, or of the vena azygos.

Wounds of the *carotid arteries* have been considered elsewhere in reference to wounds of the throat (p. 254). Questions relative to the power of locomotion perhaps more frequently occur with respect to wounds of the blood-vessels of the neck than of the heart—suicide and murder being more commonly perpetrated by the infliction of such wounds. Wounds of the carotid arteries are often pronounced *instantaneously* mortal. A witness may deliberately state that the person could not possibly have survived an instant. This is a very hazardous opinion, for it occasionally comes out, on inquiry, that if such a wound had been instantaneously mortal, then, in defiance of rational probability, or of the strongest presumptive evidence to the contrary, the deceased must have been murdered. A medical opinion of this kind has not only been refuted by circumstances, but by the evidence of eye-witnesses. There are several cases on record which show that wounds involving the common carotid artery and its branches, as well as the internal jugular vein, do not prevent a person from exercising voluntary power, and even running a certain distance. There is another circumstance which requires notice in relation to severe wounds in the *throat*—namely, that, although a person may have the power of locomotion, he may not be able to use his voice so as to call for assistance. It sometimes excites surprise at an inquest, how a murder may in this way be quietly committed without persons in an adjoining room hearing any noise; but the fact is, that when the windpipe is divided, as it generally is on these occasions, the voice is lost. In *Reg.* v. *Gooch* (Northampton Ass., Nov. 1877), it was proved that the prisoner had attacked the deceased with a knife, and had produced a severe wound in the arm. The medical evidence showed that it was a punctured wound about five inches in depth, involving the brachial artery. He lost a large quantity of blood, but a medical man arrived in time to tie the artery and thus prevent death from hæmorrhage. In three days, however, gangrene set in, and the man died from this secondary cause. The prisoner was held responsible, and found guilty of manslaughter. He had, it seems, aimed at the arm, thinking the stab would not be likely to cause death.

In reference to severe wounds involving blood-vessels, while we may allow that persons may survive for a sufficient time to perform various acts of volition and locomotion, yet the presence of a mortal wound, especially when of a nature to be accompanied by a great loss of blood, must prevent all *struggling* or violent exertion on the part of the wounded person; such exertion we must consider to be incompatible with his condition. A medical jurist may thus have it in his power to determine whether a mortal wound found on the deceased has or has not been inflicted for the purpose of murder. On wounds of other blood-vessels, whether arteries or veins, it is unnecessary to make any further remark. Death is generally owing to loss of blood, and the bleeding from a comparatively small vessel may prove fatal, according to its size, situation, and the state of the wounded person.

Death from the Entrance of Air into Wounded Veins.—In wounds of *veins* there is an occasional cause of death which requires a remark, namely, the entrance of air by the open mouth of the divided vessel. It has been long known that air injected into the jugular vein would destroy life by interfering with the functions of the heart. According to some, the air rushes into the cavity of the vessel owing to atmospheric pressure during the expansion of the heart, while others believe it to be dependent on aspiration in the act of breathing; but in some alleged cases of this kind, death has been probably caused by loss of blood. When the bleeding is slight, and the hissing sound is heard at the time of the incision, it may fairly be ascribed to the entrance of air. This opinion would be confirmed by the discovery of a frothy state of the blood in the right cavities of the heart. From the experiments of Tillaux, it appears that the injection of air into the proximal or distal end of the femoral artery of dogs produces complete paralysis of the hind legs. A post-mortem examination showed hæmorrhage and softening limited to a single point in the spinal cord. To explain the production of this effect by the injection of air into the distal end of the artery, he supposes that the air cannot pass through the capillaries into the veins, but finds its way by anastomosing arteries into the aorta, and thence into the arteries supplying the cord. After an injection of air into the carotids, patches of red softening are found in the different parts of the brain, but especially in the medulla oblongata and pons Varolii. The death of the animal is often very rapid. ('Lond. Med. Rec.,' 1873, p. 376.) According to some, death has arisen from want of contractile power in the right ventricle, occasioned by its distension with air; this may, no doubt, assist in producing the result, as over-distension of either cavity of the heart will cause paralysis of its walls. But according to Pavy the more immediate cause is the fact that air will not circulate through the capillaries like blood; the air, therefore, entering the capillaries of the lungs, blocks them up, and puts an end to the free circulation of the blood. A man was committed on a charge of manslaughter to the Chester Aut. Ass., 1885; but the grand jury returned no true bill. The deceased man, Rowbotham, and the accused, Hinds, had several scuffles and falls during a quarrel, the deceased falling uppermost. After the last fall, the deceased was suddenly seen to be in a fit, and died in a few moments. On examination, there were a few external injuries, one of which was a small wound over the root of the nose. There was general emphysema of the body, and air had by some means gained access to the heart and general circulation. The point of entrance of the air could not be ascertained, and was attributed to some injury inflicted to the air-passages during the struggle.

Wounds and Ruptures of the Diaphragm.—The diaphragm, or muscular partition between the chest and abdomen, is liable to be wounded either by weapons which penetrate the cavity of the chest or abdomen, or by the ribs when fractured through violent blows or falls; but, under any circumstances, wounds of this muscle are not likely to occur without implicating other important organs that are in contact with it. It is scarcely possible, therefore, to estimate the danger of these injuries abstractedly, as a medical opinion must materially depend on the concomitant mischief to the adjoining viscera. Slightly penetrating wounds of the diaphragm may heal like those of other muscular parts: and cases of this kind are on record. There is, however, especially when the wound is of a lacerated kind, a consecutive source of mischief which no remedial means can avert, namely, that after the wound has, to all appearance, healed, the life of a person may be cut short by the strangulation of a portion of the stomach or bowels in the half-cicatrized aperture. In a case of this description, when death occurs at a long period after the infliction of a wound, the witness may probably be required to say whether the wound was the cause of death, or whether there were any other circumstances which would have caused or facilitated the production of a hernia. The degree of responsibility of an aggressor may materially depend upon the answers returned to these questions. *Phrenic hernia*, as this form of internal rupture is termed, is not by any means an unusual or unexpected fatal consequence of a wound of the diaphragm; and therefore it would appear at first sight that death, at whatever period this event may occur, should be referred to the original wound. But the case may present some difficulties, as it is possible that a slight blow on the stomach, received subsequently to the wound, or even any violent exertion on the part of the deceased, might have produced the fatal strangulation. A person may survive with a large phrenic hernia for a considerable period, and die from some other cause. It has been stated that a person is completely incapacitated and rendered incapable of exertion or locomotion by a rupture of the diaphragm. This statement, however, has been based on limited observation. The general effect of such an injury is to incapacitate a person, but cases are recorded in which, in spite of the rupture, a person has possessed the power of moving and walking to a considerable distance.

The most serious injuries to the diaphragm are unquestionably those which are produced by violent contusions or falls on the abdomen, at a time when the stomach and intestines are distended. In these cases the muscular fibres may be ruptured to a greater or less extent; but the bleeding is not considerable, rarely exceeding two, three, or four ounces. A uniform result of these *ruptures*, when extensive, is a protrusion of the stomach into the chest, with sometimes a rupture of its coats and extravasation of its contents. Severe lacerations of the diaphragm are more readily produced during the act of inspiration than during expiration—the fibres of the muscle being then stretched, and receiving, while in this state of tension, the whole of the force. According to Devergie, the rupture most frequently takes place in the central tendinous structure, where it is united with the left muscular portion above the crura. He has remarked that it occurs more commonly on the left side than on the right. (Op. cit., t. 2, p. 250.) It has been supposed that death would be an immediate consequence of this accident; but this view is not supported by facts. In a case of extensive rupture of the diaphragm, related by Devergie, in which the stomach and colon were found in the chest, the person lived nine months after the only accident which could have produced it, and then died from another cause. Besides the stomach, it sometimes happens that the liver, spleen, or intestines pass through the opening, and, like it, these organs are liable to become strangulated; the lungs are at the same time so compressed that respiration is stopped, and asphyxia, or suffocation, may be an immediate result.

Direction of Wounds in the Chest.—In judging of the *direction* taken by wounds which traverse the chest from front to back, it is necessary to remember the great difference that exists in the level of the same rib anteriorly and posteriorly. This must be especially attended to when we are called upon to state the direction of a traversing wound from the description of it given by another. The point here referred to had an important bearing in the case of a fatal gunshot-wound, which was the subject of a criminal charge some years since. (Henke's 'Zeitschr.,' 1836.) It must not be forgotten that a wound immediately below the sternum, or chest-bone, will in its fore part involve the viscera of the abdomen, in the back part those of the chest, and in its central part it will traverse the diaphragm; owing to the great obliquity of the ribs, a straight line touching the upper edge of the sixth rib behind would be on a level with the upper edge of the third rib in front.

Wounds of the Walls of the Abdomen.—*Incised and punctured* wounds, which affect the parietes or coverings of the abdomen, without penetrating the cavity, are not quite of so simple a nature as might at first sight be imagined. The danger is immediate if the epigastric artery be wounded; for a fatal hæmorrhage will, in some instances, take place from a wound of this small vessel. Among the sources of danger from superficial wounds, is inflammation, followed by suppuration beneath the tendinous membrane which covers the abdominal muscles. The matter formed is very liable to accumulate within the sheath of the muscles, and this may prove fatal unless proper treatment be adopted. The inflammation will sometimes extend to the peritoneum, and thus rapidly destroy life. As improper medical treatment may, in either of these cases, cause a superficial wound of the abdomen to fatally terminate, so, when a person stands charged with having inflicted such a wound, it will be necessary for a medical witness to consider how far the consequences of the act of the prisoner have been aggravated by wilful neglect or unskilfulness. But when these wounds take a favourable course and heal, there is an after-effect to be dreaded, namely, a protrusion of the viscera at the cicatrized spot, constituting ventral hernia. When the wound has involved the muscular fibres transversely to their course, the cicatrix which follows is commonly far less capable of resisting the pressure of the viscera within than other parts of the parietes. A hernia may take place, and this, like other herniæ, if neglected, is liable to become strangulated, and lead to the destruction of life. The walls of the abdomen, owing to the protrusion of this cavity, are easily penetrated by pointed instruments, and it requires but a slight force to traverse them completely and wound the intestines. A slight wound may thus prove fatal by causing peritoneal inflammation.

Contusions on the cavity of the abdomen are attended generally with far more serious effects than on the chest. This arises from the coverings of the abdomen having less power to resist external shocks. In the first place, death may be the immediate result of a blow in the upper and central portions; no particular morbid changes may be apparent on inspection, and the violence may have been so slight as not to have produced any ecchymosed mark on the skin. Death has been ascribed in these cases to a fatal shock transmitted to the system through a violent impression produced on the great nerve-centre—called the solar plexus. Some remarks have already been made on sudden death from blows on this part of the abdomen (p. 287). Travers, Alison, Watson, Cooper, and other writers on surgical injuries have referred to cases of this kind as of not unfrequent occurrence. They are of considerable importance in a medico-legal point of view, as, in the absence of marks of physical injury on the part struck, a jury might be led to doubt whether the blow could have been the cause of death. Some surgeons have thought that these cases have not been accurately observed, and that in those which terminated fatally, a more careful inspection would probably have shown visible changes in the organic structures. The fact, however, remains: persons have died soon after receiving severe blows on the upper part of the abdomen, and the medical men who have examined the bodies for the express purpose of detecting physical injuries, have not found any to record. Moreover, they have not found in any part of the body a natural cause of sudden death. (*Reg.* v. *Stone*, Durham Wint. Ass., 1872.)

Blows on the abdomen, when they do not destroy life by shock, may cause death by inducing peritoneal inflammation. Violence of a severe kind applied to the abdomen is not always indicated by ecchymosis or injury to the skin. Effusions of blood in the sheaths and tendinous coverings of the muscles may or may not be indicative of violence. One fact must here be borne in mind, to prevent mistakes in examining a body after death, namely, that blood may be found copiously effused in and around the abdominal muscles, quite irrespective of the application of violence. (Reid's 'Physiol. Researches,' p. 511.) The absence, in these cases, of ecchymosis, or abrasion of the skin, is sufficient to show that such extensive effusions are not caused by violence. Blows adequate to produce a laceration of the vessels, and hæmorrhage, would most probably be attended with ecchymosis, and some visible injury to the skin. At any rate, when such marks of violence are not visible, and there is no evidence of a blow having been struck, a witness will act wisely in declining to attribute the mere effusion of blood to the act of another person. Deeply penetrating wounds of the abdomen are generally fatal by reason of the injury done to the intestines and other organs.

Ruptures of the Liver.—Blows on the abdomen may prove fatal by causing a rupture of the liver or other viscera, with extravasation of blood; and, as it has been elsewhere stated, these serious injuries may occur without being attended with any marks of external violence (p. 288). Of all the internal organs, the liver and spleen are the most exposed to rupture, owing to their compact structure, which prevents them from yielding to a sudden shock, like the stomach and intestines. Ruptures of the liver may occur from falls or blows; but this organ may be ruptured merely by a sudden action of the abdominal muscles. This accident is more likely to occur when the liver has undergone fatty degeneration, or is in an otherwise diseased state. In Dec., 1885, a case was referred to the editor where a woman (Pink) died of uræmic convulsions after delivery. There was rather extensive hæmorrhage into the substance of the liver, and beneath its investing capsule, apparently as the result of the violent muscular contractions. Ruptures of the liver are generally seen on the convex surface and in the anterior margin, seldom extending through the whole substance of the organ, but consisting of fissures varying from one to two inches in depth. The right lobe, from its size, is more usually affected than the left. Their usual direction is from before backwards, with a slight obliquity; they rarely intersect the liver transversely. The lacerated edges are not much separated, while the surfaces present a granular appearance. But little blood is met with in the laceration; it is commonly found effused in the lower part of the cavity of the peritoneum, or in the hollow of the pelvis, and is only in part coagulated. Ruptures of the liver, unless they run far backwards and involve the vena cava or portal vein, are not in general attended with any considerable effusion of blood; but the bleeding, should this vessel be implicated, is sufficient to cause the instant destruction of life. Under other circumstances, a person may survive some hours or days, as the blood sometimes escapes slowly, or it may be suddenly effused in fatal quantity as a result of violent exertion or of fresh violence applied to the abdomen. A man came into Guy's Hospital, in whom there were no immediate or urgent symptoms. He was sent away, and a few hours afterwards he was found dead in a cell at the police-station. On inspection, the liver was lacerated nearly through its diameter, and as much as a basinful of blood was found effused in the cavity of the abdomen. ('Med. Times and Gaz.,' 1864, ii. 527.) This large effusion must have taken place after the man had left the hospital. Ruptures of the liver generally prove fatal within forty-eight hours. On the other hand, death may be a slow result of this injury. In one case, a man is reported to have died from a rupture of the liver which had occurred from an accident eight days before. ('Med.-Chir. Rev.,' 1836, p. 296.) A case occurred to Wilks in which a patient in Guy's Hospital survived this serious accident ten days. The question has frequently arisen whether a person, having a rupture of the liver, can walk or exercise the power of locomotion. A case above mentioned shows that this injury does not prevent locomotion. Other cases illustrating these facts are recorded in medico-legal works. In *Reg.* v. *Chatfield*

(Maidstone Wint. Ass., 1874), the prisoner was proved to have maltreated his wife, by kicking her in the abdomen while she was in a drunken state. There was evidence that she had walked after the infliction of this violence. The liver was found ruptured, and there were extensive bruises over this part of the abdomen. The medical witness denied that the deceased could have walked with a ruptured liver, and therefore in his opinion the kicks did not cause the rupture. This was the main ground of the defence; but it was utterly inconsistent with all the other facts of the case. The prisoner was very properly found guilty of manslaughter.

Wounds and ruptures of the *gall-bladder* are necessarily attended with the effusion of bile. This irritant fluid finds its way into the cavity of the abdomen, and the person dies from peritonitis. In the *Walworth murder* case (see p. 294, *ante*) a minute puncture of the gall-bladder, and the consequent escape of bile into the peritoneal cavity, was the unsuspected cause of death.

Ruptures of the Spleen.—A rupture of this organ may be produced by bruising violence directly applied to that part of the abdomen in which it is situated, and, as in other ruptures of the abdominal viscera from violence, the skin may not present any mark of contusion. In spite of this well-known fact, a case seldom comes to trial in which the defence is not made to rest upon the absence of marks of blows over the region of the ruptured organ. In *Reg.* v. *Chapman* (C. C. C., Sept. 1877), it was proved that the deceased woman had sustained violence at the hands of the prisoner, and after death the spleen was found ruptured. There was no mark of a blow corresponding to the rupture; nevertheless, the jury were satisfied with the medical evidence of the cause of death, and found the prisoner guilty of manslaughter.

When the spleen is in a diseased condition from softening or enlargement, it is easily ruptured by slight muscular exertion, as in suddenly turning the body to avoid a fall or a blow. Several fatal cases of this kind are reported. This is an important fact in a medico-legal view. An assailant might be wrongly charged with manslaughter, while the rupture might be due to muscular pressure on a diseased spleen. ('Brit. Med. Jour.' 1878, i. p. 641, ii. p. 469.) The healthy organ is only liable to rupture by direct violence.

Ruptures of the Kidneys.—The *kidneys* are occasionally ruptured from violence; but this appears to be a rare accident. A rupture of the kidney may be produced without causing any prominent symptoms, and prove fatal in a few hours.

It may be remarked generally that ruptures of the liver, spleen, and kidneys, unless attended with immediate and copious bleeding, are not inconsistent with a person having the power to move and walk. In a case which occurred at Guy's Hospital, a man retained the power of walking for some distance, although, on inspection after death, one kidney was found torn in halves from an accident.

Ruptures and Wounds of the Intestines.—Ruptures of the intestines sometimes occur from disease; and, in a case of rupture alleged to have been produced by violence, we must always take this possible objection to our opinion into account. The ruptured part of the bowel should be carefully examined, in order to see whether there are any signs of ulceration or softening about it. If not, and there is clear evidence of violence having been used, it is impossible to admit this speculative objection. If with the proof of violence there should also be a diseased condition of the bowel, we may be required to say whether this did not create a greater liability to rupture—a point which must be generally conceded. That a rupture of the intestines is not incompatible with the power of locomotion, is proved by a case related by Ellis, of Dublin, where the cæcum was ruptured; the man was able to walk after the accident, but he died in twenty-four hours. Other instances of this kind are reported by Henke. The ileum is observed to be most liable to rupture from accident. A man was brought into Guy's Hospital. He was able to walk to his bed, and he did not appear to be seriously injured, although it was stated that a bale of wool had fallen on him. In the evening he became collapsed, and he died twelve hours after his admission. On inspection, about a pound of blood was effused in the abdomen, and a portion of the ileum was found lacerated—the laceration extending into the mesentery and including the blood-vessels. The laceration was about an inch and a half-long, and the bowel was divided not quite through. The intestines were much matted together by lymph and blood, the result of peritoneal inflammation. There had been only slight extravasation of the contents. ('Med. Times and Gaz.,' 1861, ii. p. 271; also 'Ann. d'Hyg.' 1878, t. 1, p. 137.) Croker King reported two fatal cases of ruptured jejunum—one arising from a kick on the abdomen and the other from an accidental fall. King has observed that persons who have sustained this injury retain for a time the power of locomotion and muscular exertion.

Punctured wounds, which merely touch the bowels without laying open the cavity, are liable to cause death by peritonitis. These injuries to the intestines sometimes destroy life by shock; there is but little blood effused, and the wounded person dies before peritonitis can be set up. Severe wounds to the intestines may, however, be inflicted almost without the consciousness of the individual, and the wounded person may be able to walk a considerable distance. ('Lond. Med. Gaz.,' vol. 46, p. 24.)

Wounds and Ruptures of the Stomach.—Wounds and ruptures of the stomach may cause death by shock. Ruptures commonly give rise to severe pain, which of itself is sufficient to bring about rapid dissolution. The stomach may, however, be ruptured from spontaneous causes, as in cases of ulceration resulting from disease; but sometimes there is no morbid cause apparent. Penetrating wounds of the stomach generally prove rapidly mortal, and seldom form a subject for medico-legal investigation. A singular case was tried at the Norwich Assizes in 1832, in which a man was charged with the murder of his wife by throwing at her a red-hot poker. The weapon completely perforated her stomach, and the woman died in six hours.

Ruptures of the Bladder.—This injury, which has on many occasions given rise to medico-legal discussion, is frequently the result of blows or kicks on the lower part of the abdomen. The principal questions in reference to the accident are—Was the rupture the result of wilful violence or of an accidental fall? or, did it proceed from spontaneous causes, as from over-distension? The spot in which rupture commonly takes place is in the upper and back part, where the bladder is covered by the peritoneum. The aperture is sometimes large, at others small; but the effect is that the urine is effused, and death takes place sooner or later from peritoneal inflammation. It is commonly stated that ruptures, when attended with extravasation of urine into the peritoneal cavity, are uniformly fatal; but if the rupture occurs in the under part of the bladder, so that the urine finds its way into the cellular tissue, the medical opinion is not so unfavourable. The usual period at which death occurs from this accident is in from three to seven days; but Ellis met with a case in which the person did not die until the fifteenth day. A person may die suddenly from this injury, as a simple result of shock.

When ruptures of the bladder are produced by blows they are rarely accompanied by marks of ecchymosis, or of injury to the skin. Thus, then, there may be no means of distinguishing, by external examination, whether a rupture was really due to violence or to spontaneous causes. Those who are unacquainted with this fact might be disposed to refer the rupture to disease, on the supposition that violence should always be indicated by some visible external injury; but there are numerous cases on record which show that this view is erroneous (p. 288). Rupture of the bladder has been caused by a fall in wrestling. It proved fatal in four days. (*Reg.* v. *Warburton*, Carlisle Lent Ass., 1876.)

As an attempt may be made, in cases in which death has resulted from this injury, to refer rupture of this organ to *natural causes*, it may be observed that this is a very unusual occurrence; a rupture is almost always the result of violence directly applied to the part while the organ is in a *distended* state. A *spontaneous rupture* may, however, occur: 1. When there is paralysis, with want of power to expel the urine. 2. When the bladder is ulcerated or otherwise diseased. 3. When there is an obstruction in the urethra from stricture or other causes. The causes of spontaneous rupture are easily recognizable by ascertaining the previous condition of the deceased, or by examining the bladder and urethra after death. If a man were in good health prior to being struck; if he suddenly felt intense pain, could not pass his urine afterwards, and died from an attack of peritonitis in five or six days; if, after death, the bladder was found lacerated, but this organ and the urethra were otherwise in a healthy condition; there can be no doubt that the blow must have been the sole cause of rupture and death. In such a case, to attribute the rupture to spontaneous or natural causes would be absurd. As to the absence of marks of violence externally, this would be a difficulty only to those who had not previously made themselves acquainted with the facts attending this and other accidents affecting the viscera of the abdomen (p. 354). Nevertheless, a medical witness must be prepared to hear the same line of defence continually brought forward, as it is always the object of a counsel to make the best of a case for the prisoner. With medical facts, opinions, and doctrines he does not concern himself, so long as they do not serve his purpose. A diseased state of the bladder might probably diminish the responsibility of an accused person for the consequences; therefore the state of this organ should be closely looked to on these occasions. A distended state of the organ can be no mitigatory circumstance, since it is only when the bladder is in this condition that rupture is liable to occur. This can hardly be regarded as an abnormal condition of the organ. An accidental fall forwards over a hard surface when the bladder is distended with urine may lead to rupture. The person generally experiences at the time intense pain in the lower part of his abdomen, and there is an inability to pass the urine. Although a man is liable to be rendered powerless on sustaining a rupture of the bladder from a heavy blow or fall, there are several well-authenticated cases on record which prove that a man may walk some distance, and move about even for two or three hours afterwards.

In punctured and incised wounds of the bladder the urine is at once extravasated, but in gunshot-wounds the extravasation does not commonly take place until the sloughs have separated. Thus life may be protracted longer in cases of gunshot, than under other wounds of the bladder. For the discovery of extravasated liquids or blood, in wounds and other injuries to the abdominal viscera, we must look to the cavity of the pelvis, as it is here that, for obvious reasons, such liquids have a tendency to collect.

Wounds of the Genital Organs.—Wounds of these organs do not often require the attention of a medical jurist: such wounds, whether in the male or female, may, however, prove fatal to life by excessive bleeding. Self-castration or mutilation is sometimes observed among male lunatics and idiots. When timely assistance is rendered, a fatal result may be averted. Demarquay met with a case in which a man in a fit of intoxication cut off the whole of his genital organs with a razor. He lost much blood, from the effects of which he died on the following day. ('Lancet,' 1872, ii. p. 10.) The practice of circumcision on infants is sometimes followed by fatal results. Schwartz met with two cases of boys, eight days old, who were submitted to this rite. They both died of phlegmonous inflammation, one five days and the other twenty-five days after the operation. ('Lancet,' 1870, ii. p. 471.) Other fatal cases are reported.

Incised, lacerated, or even contused wounds on the *female* genitals may prove fatal by loss of blood, not from the wound involving any large vessel, but from the numerous small vessels divided. When deeply *incised* wounds are inflicted upon the genital organs of either sex, the fact of their existence in such a situation at once proves wilful and deliberate malice on the part of the assailant. Accident is wholly out of the question, and suicide is improbable, except in cases of confirmed idiocy, lunacy, or intoxication. Such wounds require to be carefully examined; for the proof of the kind of wound, when fatal, may be tantamount to a proof of murder. A practitioner may be sometimes required to determine whether wounds affecting the female organs have resulted from accident, have been self-inflicted, or inflicted by others with homicidal intention. Accidental wounds of the genitals, unless all the circumstances are known, may sometimes resemble those produced by design. A girl, æt. 6, fell from a tree with her legs apart upon one of the sharp-pointed shoots below, about half an inch thick. This entered the vagina, and passing through its posterior wall, broke off. A woman removed the wood with some difficulty. The child died in twenty-eight hours from peritonitis. ('Lancet,' 1871, ii. p. 74.) Had this child been found dead with the wood in her body, there might have been some difficulty in assigning an accidental origin to such an injury. (For remarks by Toulmouche on the wounds of the male genital organs, see 'Ann. d'Hyg.,' 1868, t. 2, p. 110; and for cases in which such wounds were homicidally inflicted upon males, see 'Ann. d'Hyg.,' 1848, t. 1, p. 443; also 1865, t. 1, p. 66; and for a case which led to a trial for the murder of a woman, see 'Lond. Med. Gaz.,' vol. 44, p. 813.) The distinction of a homicidal from an accidental or a self-inflicted wound on the female organs is sometimes attended with great difficulty. In *Reg.* v. *Green* (Derby Wint. Ass., 1872), the medical evidence established that there was a punctured wound of the genitals in a female, and this had caused death by hæmorrhage; but it could not be clearly shown whether it was the result of accident or homicide. Unless all the circumstances are known, an accidental injury to the genital organs may present the characters of homicidal violence.

In another part of this work (p. 243) will be found reported a case in which an accidental wound on the genital organs of a girl did not prove fatal, and an attempt was made by the parents to attribute it to intentional violence. Certain persons were charged with maliciously wounding the girl, but a surgical examination of the wound showed that this was a false charge.

It has been said that lunatics, idiots, or intoxicated persons might inflict upon themselves wounds unlike those produced in ordinary attempts at suicide. A case was tried at Glasgow in 1873, in which a man was charged with the murder of his wife. They were both intoxicated when they went to bed. The prisoner during the night called to one of his daughters to come to her mother, who had been taken ill. She found her lying on the floor, and blood was flowing from her, and there was also some substance which proved to be intestine. A surgeon who was called found a clean-cut wound in the vagina, through which a portion of the bowel, with clean-cut ends, protruded. Seven feet and seven inches of intestine had been cleanly cut off in three pieces; they were not ragged. The woman died at the end of the week from loss of blood and peritonitis. The man was charged with this act; but were these injuries self-inflicted, or were they the result of homicide? It was admitted that suicide was possible, but not probable. The woman's hands were covered with blood, but the man's were not. The man was of good character. There was no known motive for either suicide or murder, and they had been married forty years, and were much attached to each other. No weapon was found with which the wound could have been inflicted. Two pocket-knives were in the trousers of the man, but there was no mark of blood upon them, and it was not thought probable that the wound had been inflicted with either. The woman had made a dying declaration, obviously false, which was that the wound had been caused by her falling over a chair, that no person injured her, and that she and her husband had always been on friendly terms. The jury returned a verdict of 'not proven.' ('Lancet,' 1873, i, p. 673.)

Contused Wounds on the female genitals may prove fatal by the laceration of parts leading to great loss of blood. Several trials for manslaughter have taken place, in which this was proved to have been the cause of death. In *Reg.* v. *Lewis* (Maidstone Lent Ass., 1876), the prisoner was charged with having caused the death of his wife by kicking her on the lower part of the abdomen. She died in a few days from inflammation. The medical witness considered that violence was the cause of death, although he would not positively swear to it. Lord Coleridge thereupon made this important observation to the jury: 'It is not because there may be the absence of absolute demonstration, which from the nature of human affairs can hardly ever be had, that therefore you should not act on your conviction. Did the violence cause death? What else could have caused it? What other cause is suggested that could have caused it?' The prisoner was convicted.

There may be such a loss of blood in these cases as to destroy life, although no large blood-vessel may be implicated in the injury. A contused wound on the vulva may occasionally present an ambiguous appearance, and be mistaken for an incised wound. When the soft parts of the body are struck by a blow or kick, if there is a bony surface beneath, a longitudinal rent resembling a cut may appear as a result of the force being received by the bone. A kick on the vulva or a fall on this part may produce a similar injury, and, unless carefully examined, may lead to the erroneous inference that a weapon has been used for its production. Some women are subject to frequent discharges of blood from the genital organs from natural causes. When the bleeding immediately follows a blow, and the woman has not been subject to such a discharge, the fair presumption is that violence was the cause; but when the flow of blood appears only a long time after the alleged violence, of which no traces can be seen, it is most probably due to natural causes. A case of this kind was communicated to the author by Procter. There was no difficulty in giving an opinion that the flow of blood was *not* due to violence.

It may be alleged in defence that the injuries found on the body were inflicted *after death*, and not while the deceased was living. Kicks or blows on the vulva, if they destroy life at all, cause death by copious effusion of blood. Violence to this part after death would not produce such an effusion as would account for death. There are also other distinguishing characters which have been elsewhere pointed out.

CHAPTER 35.

FRACTURES.—PRODUCED BY A BLOW WITH A WEAPON OR BY A FALL.—BRITTLENESS OF THE BONES.—FRACTURES CAUSED BY SLIGHT MUSCULAR EXERTION.—FRACTURES IN THE LIVING AND DEAD BODY.—HAS A BONE EVER BEEN FRACTURED?—LOCOMOTION.—DISLOCATIONS FROM VIOLENCE OR NATURAL CAUSES.—MEDICAL OPINIONS.—ACTIONS FOR MALAPRAXIS.

FRACTURES.

FRACTURES of the bones have some important bearings in relation to medical jurisprudence. They may result from falls, blows, or the spontaneous action of muscles.

Causes.—Questions are sometimes put, whether a particular fracture was caused by an accidental fall or a blow; and, if by a blow, whether by the use of a weapon or not. It is obvious that the answers must be regulated by the circumstances of each case. In examining a fracture, it is important to determine, if possible, whether a *weapon* has or has not been used; and this may be sometimes ascertained by the state of the parts. It is a common defence, on these occasions, to attribute the fracture to an accidental fall. Fractures more readily occur from equal degrees of force in the old than in the young, and in the young rather than in the adult; because it is at the adult period of life that the bones possess their maximum degree of firmness and solidity. The bones of aged persons are sometimes very brittle, and slight violence will then produce fracture. This has been regarded as an extenuating circumstance, when the fracture produced by a slight blow was followed by death. Certain diseases, such as syphilis, arthritis, cancer, scurvy, and rachitis, render bones more fragile; but they are sometimes preternaturally brittle in apparently healthy persons, and this brittleness (*fragilitas ossium*) appears to be hereditary. In such cases, a defence might fairly rest upon an abnormal condition of the bones, if the violence producing the fracture was slight. Several trials have taken place in which this brittleness of the bones became a subject of inquiry. In a case of fractured skull leading to death from inflammation of the brain, it was proved that the bones of the skull were occasionly thin and brittle, and this led to a mitigation of punishment. ('Dub. Med. Jour.,' 1839, p. 289.) The orbitar plate of the frontal bone is very thin, and it may be fractured by a blow on the eye. Death may, under these circumstances, result from inflammation of the brain. According to Mercer, in cases of general paralysis of the insane, there exists simultaneously a condition of the bones which renders them liable to fracture under comparatively slight violence. ('Brit. Med. Jour.,' 1874, i. p. 540.) The author was not aware of any facts to support this statement. Patients in asylums have been found dead with numerous fractures of the ribs, and those who had the custody of them have been convicted of manslaughter. It is scarcely possible in such cases to determine the amount of violence used, but on a post-mortem inspection it would not be difficult to determine, by the examination of a bone, whether this brittleness really existed or not. Brittleness of the bones does not excuse an act of violence, although it may mitigate the punishment when it has been proved to exist. At the same time, the attendants on the insane suffering from general paralysis should be careful not to use force in such cases.

Spontaneous Fractures.—In a case in which there is no appearance of disease, a fracture may be ascribed to spontaneous causes. Thus bones have been fractured by moderate muscular exertion. The elbow (olecranon), heel-bone (os calcis), and knee-pan (patella) are particularly exposed to this accident. The long bones are seldom the subject of an accident of this kind; but the arm (humerus) in a healthy man has been broken by the simple muscular exertion of throwing a cricket-ball. ('Lond. Med. Gaz.,' vol. xvi. p. 659.) A young lady fractured the neck of the scapula by suddenly throwing a necklace round her neck. ('Lond. Med. Gaz.,' 1842, vol. i. p. 50.) In 1858, a gentleman, æt. 40, was in the act of bowling at cricket, when, on delivering the ball, he and some bystanders heard distinctly a sharp crack like the breaking of a dry piece of wood. He fell to the ground as if he had been shot. The thigh-bone was found to be fractured, and evidently from muscular exertion only. No person can meet with an accident of this kind without being instantly conscious of it. It is probable that in these instances, if there were an opportunity of examining the bone, it would be found to have undergone some change in its composition, which had rendered it brittle. A case of spontaneous fracture of the femur was brought into Guy's Hospital in 1846. A healthy man, æt. 33, of temperate habits, was in the act of placing one leg over the other to look at the sole of his foot, when he heard something give way, and the right leg immediately hung down. On examination, it was found that the right thigh-bone had been transversely fractured at the junction of its middle with the lower third. This case is remarkable inasmuch as spontaneous fractures of the thigh-bones are very rare, and the man had not suffered from any of those diseases which cause preternatural fragility, and the fracture was not caused by violent muscular exertion. Even the end of the heel-bone (os calcis) has been broken off by the powerful action of the muscles of the calf of the leg in making a false step. ('Brit. Med. Jour.,' 1878, vol. i. p. 128.) The actual condition of the bone was, of course, unknown; but it healed readily, and the man left the hospital at the usual period. In fractures arising from this cause there would be no abrasion of the skin, nor any appearance to indicate that a blow has been struck; while the marks of a blow would, of course, remove all idea of the fracture having had a spontaneous origin. It is most unusual that the ribs should be fractured from muscular exertion; but a case occurred to Groninger, which shows that this accident may really occur. It is one of medico-legal importance, inasmuch as the injury might be easily ascribed to violence; but the absence of any external appearances indicative of a blow would render it probable that this was not the cause.

Fractures of limbs are not *dangerous to life*, unless, when of a compound nature, they occur in old persons, or in those who are debilitated by disease or dissipated habits. They may then cause death by inducing irritative fever, erysipelas, gangrene, tetanus, pyæmia, or delirium tremens.

Fractures in the Living and Dead Body.—It is not always easy to say whether a fracture has been produced *before or after death.* A fracture produced shortly after death, while the body is warm, and another produced shortly before death, will present similar characters, except that in the former case there might be less blood effused. A fracture caused ten or twelve hours before death would be indicated by a copious effusion of blood into the surrounding parts and between the fractured edges of the bones, as well as by laceration of the muscles; or if for a longer period before death, there may be the marks of inflammation. Fractures caused several hours after death are not accompanied by an effusion of blood. A medical witness may be asked—How long did the deceased survive after receiving the fracture? This is a question which can be decided only by an examination of the fractured part. Unless the person has survived eighteen or twenty-four hours, there are commonly no appreciable changes. After this time, lymph is poured out from the surrounding structures. This slowly becomes hard from the deposition of phosphate of calcium, and forms what is called a 'callus.' In the process of time, the callus acquires all the hardness of the original bone. The death of a person may take place during these changes, and a medical man may then have to state the period at which the fracture probably happened, in order to connect the violence with the act of a particular person. Unfortunately, we have no satisfactory data, if we except the extreme stages of this process of repair, upon which to ground an opinion. We can say whether a person lived for a long or a short time after receiving a fracture, but to specify the exact time is impossible; since this process of restoration in bone varies according to age, constitution, and many other circumstances. In young persons, bones unite rapidly, in the old, slowly; in the diseased and unhealthy, the process of union is slow, and sometimes does not take place at all. In those who are at the time affected with a mortal disease, there may be no attempt at reparation. According to Villermé, the callus assumes a cartilaginous structure in from sixteen to twenty-five days; and it becomes ossified in a period varying from three weeks to three months. It requires, however, a period of from six to eight months for the callus to acquire all the hardness, firmness, and power of resisting shocks possessed by the original bone. A force applied to a recently united bone will break it through the callus or bond of union, while, after the period stated, the bone will not break there more readily than through any other part. It is generally assumed that the period required for the union of a simple fracture in the adult is, for the thigh-bone, six weeks; for the tibia (leg), five weeks; for the humerus (upper arm), four weeks; and for the ulna and radius (forearm), three weeks; for the ribs, about the same period; but cases have been known in which the ribs had not perfectly united in two months, and in some fractures of the other bones it was found that union had not taken place in four months. In a case which occurred to Reid, a fracture of the tibia—the principal bone of the leg—healed in three weeks.

Has a bone ever been fractured?—This question is sometimes put in reference to the *living* body. It is well known that a bone seldom unites so evenly that the point of ossific union is not indicated by a node or projection. Some bones are so exposed as to be well placed for this examination, as the radius, the clavicle, and tibia,—these being but little covered by skin; in others, the detection is difficult. It is impossible to say when the fracture took place; it may have been six months or six years ago, as, after the former period, the bone undergoes no perceptible change. These facts are of importance in relation to the *dead* as well as to the living; since they will enable us to answer questions respecting the identity of skeletons found under suspicious circumstances; and here medical evidence may take a wider range, for a fracture in any bone may be discovered, if not by external examination, at least by sawing the bone longitudinally through the suspected broken part, when, should the suspicion be correct, the bony shell will be found thicker and less regular in the situation of the united fracture than in the other parts. So, in such cases, it will be easy to say whether a fracture is recent or of old standing.

Locomotion.—With respect to the power of *locomotion* after a fracture, it may be observed that, when the injury is in the arm or in the ribs—unless many of the ribs are broken or the fractures are on both sides—a person may be able to move about, although he is unfitted for struggling or making great exertion. Fractures of the leg generally incapacitate persons from moving, except to short distances. (See case by Syme, 'Edin. Med. and Surg. Jour.,' 1836, vol. 46, p. 255; also another in which one bone of the leg was fractured, and a power of walking some miles was retained, 'Amer. Jour. Med. Sci.,' 1845, p. 484.) The reader will find additional information on this subject in the 'Ann. d'Hyg.,' 1839, t. 2, p. 241; 1844, t. 2, p. 146; and in Friedreich's 'Ueber die Knochen in forensischer Beziehung,' Ansbach, 1853.

Dislocations.

Dislocations are not frequent in the old or in those persons whose bones are brittle. They rarely form a subject for medico-legal investigation. A witness is liable to be asked, what degree of force, and acting in which direction, would produce a dislocation—questions not difficult to answer. These injuries, except those of the vertebræ of the neck, are not dangerous to life, unless of a compound nature, when death may take place from secondary causes. A dislocation which has occurred in the *living body* may be known after death by a laceration of the soft parts in the neighbourhood of the joint, and by the copious effusion and coagulation of blood. (For an account of the appearances presented by a dislocation of the shoulder four days after death, see 'Lond. Med. Gaz.,' vol. xxxi. p. 266.) If of old standing, a dislocation would be identified by the cicatrices in surrounding structures. Dislocations may occur from *natural causes*, as from disease and destruction of the ligaments in a joint; also from violent muscular spasm during an epileptic convulsion. Dymock met with an instance of dislocation of the shoulder forwards during puerperal convulsions. ('Edin. Med. and Surg. Jour.,' 1843, vol. 59, p. 302; see also 'Lancet,' 1845, i. p. 440.) A power of *locomotion* may exist, except when the injury is in the lower limbs; but it has been observed that, for some time after a dislocation of the hip-joint, considerable power over the limb remains; it is only after a few hours that the limb becomes fixed in one position. Exertion with the dislocated member is in all cases out of the question.

Detection of Fractures. Malapraxis.—There are certain fractures of an obscure kind which closely resemble dislocations. This has been pointed out by Astley Cooper, in relation to fractures of the anatomical neck of the humerus (upper arm-bone). ('Guy's Hosp. Rep.,' 1839, p. 272.) This accident might easily be mistaken for a dislocation of the shoulder. ('Lond. Med. Gaz.,' vol. xxxvi. p. 38.) In attempting to reduce the bone, the head continually falls back into the axilla. In such a case an action for malapraxis might be brought against a surgeon. It could only be by a dissection of the part after death that the real nature of the case would be ascertained. It is requisite, therefore, that great caution should be used in giving an opinion. The same observations apply to fractures of the neck of the thigh-bone, although with less force, because this is a more common accident in older persons. It is well known that fractures and dislocations, when cured, are often attended with some slight *deformity* of the limbs, or with some impairment of its functions. This result is occasionally inevitable under the best treatment; but it is commonly set down as a sign of unskilfulness in a medical attendant. An action for malapraxis is instituted, and, in spite of good evidence in his favour, the surgeon is sometimes heavily fined for a result which could not be avoided. There is often great injustice in these proceedings, and the present system of allowing each party to select his own medical witnesses often leads to a conflict of opinion and evidence.

CHAPTER 36.

GUNSHOT-WOUNDS.—IN THE LIVING AND DEAD BODY.—WAS THE PIECE FIRED NEAR OR FROM A DISTANCE?—ACCIDENTAL, SUICIDAL, OR HOMICIDAL WOUNDS.—POSITION OF THE WOUNDED PERSON WHEN SHOT.—WOUNDS FROM SMALL-SHOT.—WOUNDS FROM WADDING AND GUNPOWDER.

GUNSHOT-WOUNDS are of the contused kind, but they differ from other wounds in the fact that the vitality of the parts struck by the projectile is destroyed, and this leads ultimately to a process of sloughing.

The medico-legal questions which arise out of gunshot-wounds are similar to those which have been examined in relation to other wounds. They are *dangerous to life*, especially when they penetrate or traverse any of the great cavities of the body. Death may take place directly, either from loss of blood or from shock; although immediate or copious bleeding is not a common character of these injuries. Death from shock is occasionally witnessed. Indirectly, these wounds are attended with much danger; sloughing generally takes place uniformly throughout the whole of the parts perforated, and inflammation or fatal bleeding may cut life short. If the person survives the first effects, he may die at almost any period from suppurative fever, erysipelas, gangrene, or from the results of operations absolutely required for his treatment. Gunshot-wounds may thus destroy life after long periods of time. A medical witness may be asked whether the wound was inflicted *shortly before or soon after death.* It is by no means easy to answer this question, unless the bullet has injured some vessel, when the effusion of blood and the formation of coagula, will indicate that the person was living when it was received. If a gunshot-wound has been produced in a dead body, no blood will be effused unless the bullet strikes a large vein.

If the person survives the injury, and the bullet can be felt in an accessible spot, it should, if possible, be removed. (See the case of *Reg.* v. *Kelly*, p. 307.) In addition to the use of Nelaton's probe (unglazed china) for detecting a bullet which was used on that occasion, a chemical method has been suggested. Lint moistened with vinegar, and secured to a flexible stem, may be introduced into the wound and allowed to remain for a short time in contact with the supposed bullet. It is then withdrawn, and placed in contact with a solution of iodide of potassium. If a leaden bullet was in the wound, it would produce a precipitate of the yellow iodide of lead. Desneux employed this method in three cases.

It must be borne in mind that death may occur from a pistol-shot, with no external wound. Ogston, jun., reports a case in which the bullet, in a case of suicidal pistol-shot, had passed through the soft palate, then through the basilar process of the occipital bone, traversed the medulla oblongata at the base of the brain, and, striking the internal occipital protuberance, had passed forwards and upwards through the brain till it reached the frontal bone. The bullet had then sunk backwards, and was found lying on the surface of the brain. ('Edin. Med. and Surg. Jour.,' vol. 29, 1884–5, p. 720.)

Was the piece fired near or from a distance?—A gunshot-wound produced by the muzzle of a piece being placed near to the surface of the body has the following characters: there may be two apertures, the one of *entrance* and the other of *exit*; but it sometimes happens that the bullet lodges and does not pass out. The edges of the aperture of entrance are generally torn and lacerated, and appear blackened, as if they had been burnt: this arises from the heat and flame of the gunpowder at the moment of explosion. The skin is often ecchymosed, and is much discoloured by the powder; the clothes covering the body are blackened by the discharge, and sometimes ignited by the flame. If the muzzle of the piece was not in immediate contact with the part struck, the wound is rounded; but if there has been direct contact, the skin, besides being burnt, is torn and much lacerated. The bleeding is usually slight, and, when it occurs, it is more commonly observed from the orifice of exit than from that of entrance. It should be remarked that the aperture of entrance is round only when the bullet strikes point-blank or nearly so. If it should strike obliquely, the orifice will have more or less of an oval or valvular form; and by an observation of this kind we may sometimes determine the relative position of the assailant with respect to a wounded person. Supposing the bullet to have been fired from a moderate distance, but so near as to have had sufficient momentum to traverse the body, then the appearance of the wound will be different: the *orifice of entrance* will be well defined, round or oval, according to the circumstances; the skin slightly depressed, the edges presenting a faintly bruised appearance, but the surrounding parts are neither blackened nor burnt, and they do not present any marks of bleeding. In these cases, the *orifice of exit* is large, irregular, the edges somewhat everted, and the skin lacerated, but free from any appearances of blackness or burning: it is generally three or four times as large as the entrance-aperture. The orifice of entrance is, however, usually large and irregular when a bullet strikes near the extremity of its range.

The entrance-aperture may have the appearance of being smaller than the projectile, owing to the elasticity of the living skin. ('Ann. d'Hyg.,' 1839, t. 2, p. 219.) It is the same with the aperture in the dress, when this is formed of an elastic material. According to Dupuytren, the hole in the dress is always smaller than that made by a bullet in the skin. These points should be remembered in fitting projectiles to wounds which they are supposed to have produced.

In recent times, bullets of a novel kind have been employed, and the appearances presented by gunshot-wounds have differed accordingly. Busch has directed attention to this point. He found that a chassepot-bullet, shot from a short distance into the human body, made a simple aperture of entrance, but that its aperture of exit was larger than a fist, and that there was very extensive fissuring and fracturing of bone. Bullets of soft lead produced larger apertures of exit than those made with hard lead. There is no essential difference in the action of bullets on the living or dead body as to appearance and extent. The wounds are not more extensive in the living than in the dead. ('Med. Times and Gaz.,' 1874, vol. i. p. 616.)

The question whether a piece was fired *near to, or at a distance from*, the wounded person, may be of some importance either on a charge of homicide or of alleged suicide. Two persons may quarrel, one having a loaded weapon in his hand, which he may allege to have been accidentally discharged and to have killed the deceased. If the allegation be true, we ought to find on the body the marks of a near wound; if, however, its characters are such that it has obviously been produced from a distance, and therefore after the quarrel, medical proof of the fact might imply malice, and involve the accused in a charge of murder. The following case occurred in Ireland in 1834. A tithe-collector was tried for the murder of a man by shooting him.

It appeared in evidence that the prisoner, while on duty, was attacked by the deceased and two of his sons, and he drew a pistol to intimidate them. He was dragged off his horse by these persons, and during the scuffle, it is supposed, the pistol was discharged accidentally, and inflicted on the deceased a wound, of which he died shortly afterwards. The sons of the deceased swore that the prisoner took a deliberate aim, and fired the pistol at their father when at some distance; and a priest came forward to depose that such was the dying declaration of the deceased. From some doubt of the truth of this story, the body, which had been carelessly inspected in the first instance, was ordered to be disinterred. It was again examined by a surgeon, who was enabled to swear positively that the pistol must have been fired close to the body of the deceased, and not at a distance, since there were the marks of powder and burning on the wrist. Hence it clearly followed that the pistol had not been discharged at a distance, but during the scuffle, either by accident or in self-defence. The prisoner was acquitted, and the parties who had appeared as witnesses against him were convicted of perjury.

It has been said that, when a bullet is fired close to the body, it commonly traverses it; and therefore it has been rather hastily assumed that, when there is only one external wound, and the bullet has lodged in the body, this is a proof that the piece has been fired from a distance. This inference is, however, erroneous. A bullet may be fired close to a person and yet not traverse the body, either from its impulsive force not being sufficiently great, or from its meeting with great resistance in its course. Many cases might be cited to show that, in the near wounds produced by suicides and murderers, the bullets have not always traversed the body. In suicide, when the piece is discharged into the mouth, the projectile often lodges in some part of the head. It is not in the power of a witness to say, from the mere fact of a bullet lodging or traversing, whether the assassin was far off or near, at the time that the deceased was wounded. The latter point may be sometimes readily determined by the marks of injury and burning about the skin and dress. When a gun or a pistol is discharged at a distance of three or four yards from the person, it will not, of course, produce those marks of blackening, burning, and bruising on the skin which are found when the muzzle is within a few inches of the body. A wound which does not present these appearances may remove the suspicion of suicide, and create a strong presumption of homicide. Lachèse found ('Ann. d'Hyg.,' 1836, p. 368) that, in firing a gun at a distance of four feet, the skin was only partially blackened. It would be very important in a case of this kind to notice the *direction* of the wound, as well as the relative positions of the assailant and assailed, as stated by witnesses or deduced from circumstances. When a ball traverses the body, it sometimes happens that the two apertures are opposite to each other, although the ball may not have taken a rectilinear course between them, but have been variously deflected by the subjacent soft parts. This deflection of a ball from a rectilinear course is met with in those cases in which it happens to strike obliquely a curved surface, and it is found that, when the ball enters and does not pass out, its course is often circuitous, so that it is not always easy to surmise in what part of the body it will be found.

A witness may be asked—When was the gunshot-wound inflicted? and how long did the wounded person *survive* after receiving it? A gunshot-wound undergoes no obvious change for eight or ten hours after its infliction. Our judgment in reference to these questions may be assisted by observing the parts which are involved, although we cannot always infer, from the quantity of blood found near to a body, that the bleeding was an immediate consequence of the wound, or that the whole of the blood was effused at once. We cannot, then, always affirm that the deceased could not have moved or exerted himself in some degree after receiving it. The exertion thus made subsequently to his being wounded may have actually caused the fatal bleeding.

Suicidal and Homicidal Gunshot-wounds.—When it is doubtful whether the wound was the result of suicide or homicide, the point may be sometimes determined by paying attention to its situation and direction. *Suicidal* gunshot-wounds are almost always directed to a vital part—to the heart or to the brain; they possess those characters which belong to wounds inflicted near to the body: the skin is discoloured or burnt, the wound wide and lacerated, the hand which discharged the weapon often blackened, and sometimes still grasping the pistol. The ball may or may not have traversed, as this will depend on the momentum which it derived from the charge, and the resistance which it experienced.

On the occasion of the trial for the Uxbridge murder (*Reg.* v. *Gibbons*, C. C. C., Dec. 1884), several important questions arose as to the suicidal or homicidal character of four gunshot-wounds found by Boulby on the body of the deceased. One of the bullets had penetrated the heart. The prisoner was convicted. ('Brit. Med. Jour.,' 1885, i. p. 62.)

Accidental gunshot-wounds bear the characters of near wounds: they may touch vital parts, but, if the body has not been disturbed, the presence or absence of design in the infliction of a wound is commonly made apparent by the relative position of the body and the weapon. They frequently arise from persons drawing the charges of guns or pistols with the muzzles pointed towards them, and they are then situated in front; at other times they are produced by persons pulling towards them through hedges, or dragging after them, loaded guns. In the latter case the wound is behind, and it may strongly resemble a homicidal wound, although the circumstances under which the body is found generally suffice to explain the matter. ('Ann. d'Hyg.,' 1860, t. 1, p. 443.) A loaded gun had been placed on the top of a corn-bin in a stable. A fowl trod upon the trigger, and thus fired the gun. It seriously wounded an old man who was near. This shows by what a strange coincidence a man may be found shot with his own gun, and how difficult it might be to reconcile the discharge of the gun with any accidental circumstances. In *suicide*, there is commonly strong evidence of design; in accident, all evidence of design is wanting. Suicides sometimes make use of extraordinary weapons, or use weapons in an extraordinary manner.

On Jan. 18th, 1881, the body of a lawyer, named Bernays, was found in a chair, in a sitting posture, in a house into which he had been inveigled eleven days previously. There were two pistol-shot wounds—one in the right temple, of a simple character; the other, and fatal wound, was in the nape of the neck. The latter was a perfectly clean wound, without any singeing. The ball had gone through the neck from left to right, slightly ascending, and had perforated the skull. There were blood-stains on the nape of the neck, and on the right side of the head. The bleeding from the fatal wound was internal, and there was little blood on the clothes. There was a small pool of blood on the carpet; and on this, it is alleged, was the impress of a foot. This must have been made after the blood had gelatinized. It was endeavoured to be shown, however, by the defence, that the footprint might have been made not more than ten or fifteen minutes after the effusion of blood had taken place. The prisoner, Léon Peltzer, was convicted, and admitted the justice of the conviction. When, however, experts differ, as in this case, as to whether a mark on a pool of blood weighing nine ounces has been produced by a boot or by a trouser-covered knee, the evidence ought to be rejected. (See 'Brit. Med. Jour.,' 1883, i. p. 23.)

Position of the Wounded Person when shot.—Did the deceased receive the shot while standing, falling, or lying down? Was the piece, when discharged, pointed from the shoulder? These questions can only be answered by reference to the particular circumstances of the case. In general, when a person is shot while standing, and the piece is pointed from the shoulder, the wound is more or less transverse; but due allowance must be made for the deflection of balls after penetration. Was the deceased shot while running away, or when approaching the person who fired? This question is answered by observing, in the case of a traversing wound, in which alone any difficulty can arise, whether the entrance-orifice be situated in front or behind.

Wounds from Small-shot.—Death is sometimes occasioned by small-shot; and here several medico-legal questions present themselves. Small-shot may act in two ways: (1) it either strikes without spreading, in which case the discharge is always near the person shot, and its action is much more dangerous than that of a single ball, because it produces extensive lacerations; or (2) it strikes after it has spread, and here the discharge must have been distant, and comparatively little mischief is done. Lachèse ascertained, by many experiments on dead bodies, that in order to produce, with small-shot, a round opening somewhat resembling that produced by a bullet, the discharge should take place point-blank at the distance of about ten or twelve inches from the surface of the body. When the distance was from twelve to eighteen inches, the opening made was irregular, and the borders were much lacerated; at thirty-six inches, a central opening was entirely lost, and the surface of the body was covered with shot-marks. The effect after this was found to depend on the distance, the kind of gun, and the strength of the charge ('Ann. d'Hyg.,' 1836, p. 386); but the shot is, in general, much scattered over the surface of the body. From these results we may form an opinion of the distance at which the piece was fired.

It is difficult to conceive that small-shot can, under any circumstances, produce a single entrance-wound, having some appearance of circularity about it, without at the same time singeing or burning the skin or dress. The difficulty of laying down any general rules respecting the wounds produced by small-shot at their entrance and exit will be apparent from the following facts. A boy was shot in the neck by the accidental discharge of his gun, loaded with an ounce of No. 8 shot. He died instantly. He was leaning forwards on the muzzle, so that it was nearly in contact with the skin of the neck. A large round hole was produced, one inch and a half in diameter, the edges of which were slightly blackened with powder. The exit-aperture, which was at the back of the neck a little to the left of the third cervical vertebra, was a mere slit in the skin, scarcely an inch long, with the long diameter placed vertically. The smallness of this aperture may have been owing to the greater part of the charge being lodged in the body. The entrance-aperture, although rounded, was too large to be mistaken for a bullet-wound; it was evidently a near wound, from the blackening of the edges. On the other hand, Lowe found that a round aperture might be produced by a discharge of small-shot at a much greater distance from the object than that assigned by Lachèse. Admitting such exceptional instances, and assuming the general correctness of the inferences drawn by Lachèse from the results of his experiments in discharging small-shot at dead bodies placed at different distances, it does not seem probable that a wound from small-shot can, under any circumstances, be mistaken for one produced by a leaden *bullet*. A discharge of small-shot, in contact with the skin or close to it, will, however, produce, not a round opening, but a severe lacerated wound.

Small-shot is rarely observed to traverse the body entirely, unless discharged so near as to make a clean round opening; but a single pellet reaching the body may destroy life. There may be no exit-aperture, or it may be smaller than that of entrance. Such minute wounds might be easily overlooked in the examination of a dead body. Small-shot, even when wounding only the skin of the back superficially, has been known to cause death by tetanus.

Wounds from Wadding and Gunpowder.—It matters not with what the piece is charged, it is capable, when fired near, of producing a wound which may prove fatal. Thus a gun loaded with wadding, or even with gunpowder only, may cause death. In these cases, an impulsive force is given by the explosion, and the substance becomes a dangerous projectile. The lighter the projectile, the shorter the distance to which it is carried; but when discharged near to the body, it may produce a fatal penetrating wound. A portion of the dress may be carried into the wound, and lead to death from bleeding; or, if the wounded person recover from the first effects, he may subsequently sink under an attack of tetanus or erysipelas. It is unfortunate that so much ignorance prevails on this point; for fatal accidents frequently occur from persons discharging guns at others in sport—an act which they think they may perform without danger, because they are not loaded with ball or shot.

It has been observed that persons, in attempting to commit suicide, have occasionally forgotten to put a bullet into the pistol; nevertheless, the discharge of the weapon into the mouth has sufficed, from the effect of the wadding only, to produce a considerable destruction of parts, and to cause a serious loss of blood. Fatal accidents have frequently taken place from the discharge of wadding from cannon during reviews. It is not easy to say at what distance a weapon thus charged with wadding and powder would cease to produce mischief, since this must depend on the impulsive force given by the powder, and on the size of the piece. Lachèse ascertained that a piece charged with gunpowder is capable of producing a penetrating wound somewhat resembling that caused by small-shot, when the piece is large, strongly charged, and fired within six inches of the surface of the body. ('Ann. d'Hyg.,' 1836, p. 368.) This arises from a portion of the powder always escaping combustion at the time of discharge, and each grain then acts like a pellet of small-shot. Under any circumstances, a discharge of powder only, contuses the skin, producing ecchymosis, and often lacerating it, if the piece be fired near. The dress is burnt and the skin scorched from the globe of flame formed by the combustion of the powder; and many particles of gunpowder may be actually driven into the true skin. All the substances here spoken of are considered to be projectiles; and the weapons are held in law to be loaded arms, so long as they are capable of producing bodily injury at the distance from which the piece containing them is discharged. It may, therefore, become a question as to the distance at which these light projectiles cease to be harmless. The answer must be governed by circumstances; but it will in all cases materially depend on the strength of the charge. Swift performed some experiments with a pistol loaded with gunpowder and *wadding*, in order to determine the effect of a discharge at different distances. At twelve inches' distance from a dead body, he found that the clothes were lacerated and the skin abraded, but the wadding did not penetrate; at six inches, the clothes were lacerated, and the wadding penetrated to the depth of half an inch; at two inches, the wound produced, which was two inches deep, was ragged and blackened; at an inch and a half from the chest, the wadding passed into the cavity between the ribs, and in a second experiment it carried away a portion of a rib. ('Lond. Med. Gaz.,' vol. xl. p. 734.)

This subject was investigated by Mackintosh, and he forwarded to the author the results of his experiments. As a summary, he found, in reference to the wounds produced by wadding, that the amount of injury done is in proportion to the amount of powder in the gun, the hardness and compactness of the wadding or substance used in place of shot or bullet, and the distance of the object from the point of firing. A case occurred in his practice which was the subject of a trial for unlawful wounding. (*Reg.* v. *Isgate*, Norwich Aut. Ass., 1867.) The prisoner fired at a boy with a gun loaded with pieces of brown paper pressed together. He was then at a distance of two or three yards from the boy. There was a wound in the chest about the size of a shilling. The margin of the wound was jagged, had a bluish-black or mottled appearance, and the edges of one of the ribs were laid bare. The pellet took a course downwards, as a result of its deflection by the rib. A quantity of brown paper was removed from the wound, and the boy ultimately recovered. The question which Mackintosh proposed to consider was whether paper-wadding could really produce such a wound as was here found, when the gun was fired from a distance of *two or three yards*. Without going into details, it may be stated that, when the gun was charged with a small quantity of powder and brown-paper wadding, there was indentation, but no penetration at a distance of two yards. With one-third more powder and a brown-paper pellet closely compressed, there was penetration through the boy's jacket to an inch and a half beyond. These facts bear out the conclusion already given, and confirmed the boy's account of the distance from which the gun was fired at him by the prisoner. Swift had inferred from his experiments that a penetrating wound from wadding was not produced unless the piece was discharged within a distance of six inches; but Mackintosh's results clearly show that this must depend on the quantity of powder used, and the loose or condensed nature of the substance employed as a projectile.

Examination of Firearms.—An attempt has been made by French medical jurists to determine for how long a period a gun or pistol found near a dead body may have been discharged; but it is out of our power to lay down any precise rules on such a subject. All that we can say is that a quantity of sulphide of potassium, mixed with charcoal, is left adhering to the barrel of the piece, when *recently* discharged; and this is indicated by its forming a strongly alkaline solution with water, evolving an odour of sulphuretted hydrogen, and giving a deep-brown precipitate with a solution of acetate of lead. After some hours or days, according to the degree of exposure to air and moisture, the saline residue becomes converted into sulphate of potassium, forming a neutral solution with water, and giving a white precipitate with acetate of lead. If a considerable time has elapsed since the piece was discharged, oxide of iron, with traces of sulphate, may be found. (See 'Ann. d'Hyg.,' 1834, p. 458; 1839, p. 197; 1842, p. 368.)

When called to a case of gunshot-wound, either accidental or criminal, it is always proper to examine the piece, if found. Has it or has it not been recently discharged? may be a material question. This is best determined by a gunsmith. A trial took place on the Western Circuit, March, 1873, in which the fact was of great importance. The prisoner asserted that his gun had not been used for a long time. On examination of the barrel, however, it was found to have been quite recently discharged. This at once connected him with the act of wounding of which he was accused. In an agrarian murder in Ireland, in 1876, there was found imbedded in the heart of the deceased the half of a common marble such as children use in play. A bag of marbles of the same size and kind was found in the house of one of the prisoners, and this discovery connected him with the act.

The examination of wadding or paper found in a gunshot-wound or near a dead body has in more than one instance led to the detection of the person who had committed a crime. The handwriting has been traced on the paper used as wadding, or it has been found to have been part of a printed page, of which the remainder has been discovered in the possession of the accused. When a gun is discharged near to the body, a portion of the wadding is generally carried into the large irregular wound which is produced. This was part of the evidence in the case of *Reg.* v. *Blagg* (Chester Sum. Ass., 1857). The peculiar character of the wadding found in the body connected the prisoner with the act. Whether the wadding is found in or near the body, it should be equally preserved. In *Reg.* v. *Richardson* (Lincoln Ass., Dec. 1860), the accused was convicted of murdering a policeman under the following circumstances. He shot at the deceased, who was able before death to identify the prisoner; but as the deceased was weak from loss of blood, and failing in consciousness at the time, there was some difficulty in relying upon the dying declaration, especially as no other person witnessed the act. Some paper-wadding had been picked up on the spot where the deceased fell; and a gun, which had one barrel loaded and one empty from a recent discharge, was found in the prisoner's house within twenty-four hours of the murder. The wadding in the loaded barrel consisted of a fragment of the *Times* newspaper of March 27, 1854, and the charred and sulphurous pieces of wadding picked up on the spot were proved by the publisher of that journal to have formed a portion of the same impression. The prisoner's counsel, in fact, could not deny that the act had been brought home to the instrument, if not to the agent, and, though the explanation of the crime remained obscure to the last, and the motive unassignable, the aggregate evidence proved sufficient to convince the jury. Any projectiles found in a gunshot-wound should always be preserved for evidence. In the case of *Rush*, who was tried and convicted of the murder of *Mr. Jermy* by a remarkable train of circumstantial evidence (Norwich Lent Ass., 1849), it was proved that the projectiles removed from the body of the deceased consisted of irregular pieces of lead (slugs). Similar masses were taken from the body of the son, who was killed at the same time. They were described by the medical witness as being angular, and quite unlike the shot used in killing game. This proved that the two acts of murder were committed by the same person, or by this person acting in concert with others.

The chemical analysis of a projectile may be occasionally necessary. A common bullet is formed entirely of lead. Cast bullets are commonly found to have a void space in the interior when cut through the centre, owing to the exterior cooling more rapidly than the interior, and to the greater bulk of the metal when in a liquid state. In large bullets this cavity is frequently of the size of a barleycorn. Bullets obtained by compression have no such space, and are of greater specific gravity. Small-shot is composed of lead with a minute portion of arsenic (1-200th part). If the arsenic is in large proportion, the shot is lenticular; if absent, or in small proportion, pyriform (Ure). In the case of *Rush*, type-metal was found in the house. This consists of lead with one-fourth part of antimony. The slugs were found to consist chiefly of lead, and to contain no antimony. The type-metal was thus excluded.

CHAPTER 37.

DEATH FROM BURNS AND SCALDS.—SYMPTOMS.—STUPOR.—CAUSE OF DEATH.—POST-MORTEM APPEARANCES.—BURNS ON THE DEAD BODY.—ACCIDENT, HOMICIDE, OR SUICIDE.—WOUNDS CAUSED BY FIRE.—SCALDING.—BURNS BY CORROSIVE LIQUIDS.

Burns and Scalds.—A *burn* is an injury produced by the application of a heated substance to the surface of the body; while a *scald* results from the application of a liquid at a high temperature under the same circumstances. There seems to be no real distinction between a burn and a scald in reference to the effects produced on the body: the injury resulting from boiling mercury or melted lead might take either appellation. Nevertheless, as a matter of medical evidence, it may be important to state whether the injury found on a body was caused by such a liquid as boiling water or by a heated solid. If the former, the injury might be ascribed to accident; if the latter, to criminal design. A scald produced by boiling water would be indicated by a sodden state of the skin and flesh, but there would be no destruction of substance. In a burn by a heated solid, the parts may be more or less destroyed or even charred; the cuticle may be found blackened, dry, almost of a horny consistency, and presenting a shrivelled appearance. This distinction, however, would only apply to scalds from water. A scald from melted lead (633° F.) could not be distinguished from a burn produced by a solid heated to the same temperature. Some of the oils boil at 500° F., and they produce, by contact with the skin, burns as severe as those caused by melted metal. Burns from flame, such as that of gas, are indicated by extensive scorching of the skin, while burns from gunpowder are known, not only by the scorching, but by the small particles of unburnt carbon which are imbedded in the skin.

Neither a burn nor a scald appears to be considered as a *wound* in law; but in the statute of wounding they are included among bodily injuries dangerous to life. Burns and scalds may be regarded as dangerous in proportion to the extent of surface (of skin) which they cover, as well as the depth to which they extend. The extent of skin involved in a superficial burn, as a result of exposure to flame, is of greater importance than the entire destruction of a small part of the body through an intensely heated solid. When the burn is extensive, death may ensue either from the severity of the pain produced, or from a sympathetic shock to the nervous system. Death takes place rapidly from burns in children and nervous females; but in adults and old persons there is a better chance of recovery. In some instances, especially in children, stupor and insensibility supervene, owing to the sympathy of the skin with the brain; and these symptoms have been soon followed by coma and death. If, under these circumstances, opium has been given to the patient as a sedative, the stupor resulting from a burn may be attributed to the narcotic effects of the drug; and, should the person die, the practitioner may find himself involved in a charge of malapraxis or manslaughter. It may be alleged, as in the following case, that the person was poisoned with opium. A medical man was charged with the manslaughter of a child, by giving to it an overdose of opium while it was labouring under the effects of a severe scald. Abernethy stated in his evidence, which was given in favour of the practitioner, that he thought the use of opium was very proper; that the quantity given—eight drops of tincture of opium immediately after the accident, and ten drops two hours afterwards—was not an overdose for a child (the age is not stated). The circumstance of the child continuing to sleep until it died, after taking the opium, was, in his judgment, no proof that it had been poisoned. The sleep was nothing more than the torpor into which it had been plunged by the accident. The surgeon was acquitted. Notwithstanding the very favourable opinion expressed by Abernethy of this plan of treatment, it would be advisable to avoid the use of opium on these occasions in treating infants and children. Life is readily destroyed in young subjects by the smallest doses of this drug; and there are no satisfactory means of distinguishing the comatose symptoms produced by a burn or a scald from those produced by an overdose of opium (p. 164).

Cause of Death.—In some instances, especially in children, stupor and insensibility have rapidly supervened; and these symptoms have been followed by coma and death. Of the cause of death in persons exposed to fire, little need be said. In large conflagrations persons are frequently simply suffocated, from the want of a proper amount of air or from breathing the products of combustion—carbonic acid or carbonic oxide. The former darkens the blood and muscles; the latter renders them lighter in colour. In other cases, where a large volume of flame suddenly falls upon the body and the person is still able to breathe, the fatal effect may be due to shock—a sudden and violent impression on the nervous system through the skin. A person may recover from the first effects of severe burns, but ultimately sink from exhaustion or from an attack of tetanus. ('Med. Times and Gaz.,' 1854, i. p. 406; see 'Ann. d'Hyg.,' 1873, t. 1, p. 232.) The annual deaths from burns and scalds are numerous. According to the returns of the Registrar-General, from 2000 to 3000 deaths per year occur from this cause.

Post-mortem Appearances.—In examining the body of a person found burnt, all matters connected with sex and identity should be first duly observed. Grünbaum has reported a case in which he was required to examine certain carbonized remains, in which, in spite of the destruction of the sexual organs, he was able to determine the sex. (Horn's 'Vierteljahrsschr.,' Oct. 1864.) When a body has been entirely consumed by fire, the presence of a large quantity of phosphate of calcium in the ashes would indicate animal remains. The bones are never completely destroyed; they become white, and the mineral portions of them retain their form even after the action of a most intense fire. When death has been caused by severe pain, no changes have been detected in the dead body; but, in some fatal cases, it has been found on inspection that there were patches of redness on the bronchial mucous membrane, as well as in the stomach and intestines. The brain has been found gorged, and the ventricles have contained an abundance of serosity. The serous liquids of the pericardium and pleura have also been in larger quantity than natural. In short, besides congestion, there is generally abundant serous effusion in one of the three great cavities, especially in the head. This arises from the sudden reflux of blood into the interior, as an effect of the local injury. In deaths from fires in houses, the persons are usually suffocated, and then there are the appearances of this kind of death. (See Suffocation, *post.*) In a case in which a woman died on the thirteenth day, from a superficial burn involving the skin of the lower part of her body, the stomach was found inflamed at its greater extremity, and the duodenum at its lower portion, the mucous folds of the intestines having a scarlet colour. The other intestines as far as the cæcum were also more or less inflamed. ('Amer. Jour. Med. Sci.,' 1861, p. 137.) If the person survive the first effects, he may die from inflammation, suppuration, gangrene, irritation, or fever, or he may be worn out by exhaustion. Schjerning has recently collected the records of a large number of post-mortem examinations in deaths from burns and scalds. ('Vierteljahrsschr. für Gerichtl. Med.,' 1884, xli. pp. 24, 273.)

Did the burning of the Body take place before or after Death? Vesication.—The production of *vesication* or of *blisters* containing *serum* is commonly regarded as an essential character of a burn which has been produced during life, but it is not a necessary or invariable effect of a burn on the living body. Vesication is especially observed in scalds, or in those cases in which the skin has been burnt by flame or by the ignition of the clothes, provided the cuticle has not been destroyed. It is not so commonly observed in burns produced by intensely heated solids. In vesication, the cuticle is raised from the true skin beneath, and is converted into one or more blisters containing serum or a serous liquid, while the skin around is of a deep-red colour. It is uncertain as to the time at which it appears: it may be produced in a *few minutes*, or sometimes not for several hours; hence death may take place before vesication occurs, and the non-discovery of this condition does not warrant the opinion that the burn could not have taken place during life. If the cuticle is removed from a vesicated part of the living body, the skin beneath will become intensely reddened; but if the cuticle is stripped off a dead body, the skin will become hard, dry, and of a horny-yellow colour,—it does not acquire the intense scarlet injection which is acquired by the living skin when vesicated and the surface is exposed.

In cases in which persons, while living, have suffered from general dropsy, it has been found, on the application of heat to their bodies after death, that blisters containing serum or a serous liquid have been formed; hence, in drawing a conclusion from the examination of *burns* on the body of a person affected with general dropsy, it is necessary to be cautious. In such cases it would not be possible, from the mere presence of serous blisters, to say whether the burn was produced before or after death. Wright found, in his experiments on the dead body, that if a sufficient heat were closely applied to the skin within half an hour or longer after death, blisters containing serum were sooner or later produced. In short, as long as the body was warm and the joints were flexible, the effects of fire were similar to those observed on the living. Other experimentalists have found that blisters were produced, but that they did not contain serum. The result no doubt depends on the time after death at which the experiment is performed. The body of a drowned man, within a few minutes after the accident, was removed from the water and placed in a warm (hot?) bath. It was found impossible to resuscitate him, but, owing to the great heat of the water, portions of the cuticle came off, when the body was removed. On inspection, there were several vesications *filled with bloody serum* over a considerable portion of the skin, especially of the extremities. There was no anasarca (dropsy) here to account for the production of the blisters. In this case the man was pulseless and to all appearance *dead*, when placed in the hot bath; hence the effects of hot water on the living and recently dead body, so far as the production of serous blisters is concerned, are similar. Chambert has published the results of numerous experiments on the effects of burns on the living and dead body. These have been made on the bodies of persons, from the moment of death until twenty hours after dissolution, and some were performed before death. The general results of his researches are that vesications, or blisters, may be produced by burns both on the living and dead body; that they are produced at a lower temperature in the living than in the dead; that in the living a burn produces great capillary congestion, with the effusion of serum in the blisters; and that this serum when heated, or treated with nitric acid, sets into a nearly solid coagulum. The blisters produced in a dead body, even a few minutes after death, contain a thin watery serum, which is only rendered opaline or milky by heat and the action of nitric acid. (‘Ann. d’Hyg.,’ 1859, t. 1, p. 342.) When a body is cold and rigid, blisters containing air or vapour alone are produced. Bouchut found that, by the application of heat, he could produce vesicles containing a watery serum, sometimes bloody, within twelve, eighteen, and twenty-four hours after death. (‘Gaz. Méd.,’ March, 1847; and ‘Ann. d’Hyg.,’ 1878, i. p. 509.)

In burns, especially in those produced by red-hot solids, other effects besides vesication follow. The edge of the skin immediately around the part burnt is commonly of a dead white, and close to this is a *deep-red line*, gradually shaded off into the surrounding skin, which is reddened. The diffused redness is removable by pressure, and disappears with life; the red line here referred to, however, is not removable by pressure, and is persistent after death. This line of redness is not always met with in severe burns, and when a person survives one or two days, its production appears to depend upon a power of reaction in the system. Thus, then, its absence furnishes no proof of the burn having been produced after death, for it is not a necessary accompaniment of a burn during life. Wright considered that in a low state of vitality a line of redness might not be produced by a severe burn on the living body, and that more certain reliance may be placed on the red marks found beneath the blisters and crusts of vital burns. These latter were well marked when he found the line of redness itself indistinct. ('On Vital and Post-mortem Burning,' p. 25.) The researches of Chambert confirm this view. In a burn on a living person, if the skin has not been entirely charred and destroyed, the cutis will present a dotted or pointed redness—these dots or points corresponding to the sudiparous (perspiratory) and hair follicles. After complete death, a burn does not produce any such effect—the cutis is of a dead whiteness on the surface and in its substance. In one experiment performed, ten minutes after death, there was no redness of the skin, either beneath the blisters or in the surrounding parts. ('Ann. d'Hyg.,' 1859, t. 1, p. 368.) This reddened or congested state of the bare skin is more constant than any other appearance, and forms the best criterion of the infliction of a burn on the living body. The conclusions that we may draw from the foregoing statements are: 1. That, as a general rule, when we discover blisters with effusion of serum, or a line of redness, or both, and a reddened or congested state of the skin, about a burnt part of the body, we are justified in saying that the burn has occurred during life. 2. That from the absence of these appearances, it does not necessarily follow that the burn has not been produced in the living body.

When *several burns* are found on a dead body, it may be a question whether they were all produced at the same time. This is a point which can be determined only by observing whether any of them present signs of gangrenous separation, of suppuration, granulation, or other changes that take place in a living body after accidents of this kind. The witness may be asked—How long did the deceased survive the burn? A person may die in a few minutes or live some hours after receiving a most extensive burn; and yet there will be no change in the part burnt, to indicate when death actually took place. There may have been no time for inflammation or its consequences to become established. Suppuration generally follows vesication, and in severe cases it may occur on the second or third day; but often not until a later period. In regard to gangrene, this takes place when the vitality of a burnt part is destroyed. The time of its occurrence is uncertain, but it sometimes very speedily follows the accident.

The subject of *scalding* or *boiling* scarcely requires a separate notice. A scald from boiling water would, when recent, be indicated by the production of serous blisters, or a sodden state of the skin, which appears white and soft. The living structures are not charred or destroyed as by the application of a red-hot solid. In a remarkable case of alleged child-murder (*Reg.* v. *Goodfellow*, Winchester Wint. Ass., 1876), the body of the child was found in a saucepan covered over, and it was evident from its appearance that it had been thoroughly boiled. The main question was—Had the child been put living or dead into the water? The prisoner admitted that the child had breathed once, and that she had then placed the body where it was found. According to one medical witness, all the organs were healthy, but the action of boiling water upon the body had so destroyed the means of testing the lungs, that it was difficult to say whether the child had breathed or not. He was of opinion that the child was dead when put into the saucepan. Another physician, relying upon the presence on the body of blisters containing a yellow serum, believed that the child was alive when its body was put into the water. The judge thought this to be too doubtful a point to rely upon in the absence of evidence from the lungs. The woman was acquitted of the murder, but found guilty of concealment of birth.

Accident, Homicide, or Suicide.—It is rare that murder is perpetrated by burning: the dead body is either burnt for the purpose of entirely destroying it, or the clothes are fired soon after a person has been killed, in order to conceal wounds or other violent means of death, and to make it appear as if the deceased had been accidentally destroyed by fire. (*Reg.* v. *Lee*, Exeter Ass., Jan. 1885.) Death by burning is either the result of accident or homicide, most commonly the former; but medical evidence may give rise to a suspicion of murder under two conditions: 1. When it is evident that several parts of the body or clothing have been fired at the same time, and the burns are such as not readily to be explained by the same accident or by the accidental ignition of the clothes. 2. When there are marks of homicidal violence on the body; but these marks, if we except fractures of the bones, may be easily effaced when the burn is extensive.

Time required for the Burning of a Dead Body.—It may be a medico-legal question whether, on discovering a body much burnt, it could be determined from its appearance how long a period it would require to produce the amount of destruction observed. Such a question may arise when it is intended to connect a person with the perpetration of an alleged crime, but it does not admit of a precise answer. A conjecture only can be formed from the facts proved in each particular case. The human body contains a large proportion of water (72 per cent.); this gives to the soft structures a power of resisting combustion. At the same time, there is a quantity of fat in the body, varying in different parts, but amounting to an average of about five per cent. The fat or oil tends to increase its combustibility, and this is still further increased if the body is placed on any combustible article which can imbibe the oil, such as a rug or a deal floor. The nature of the dress will also make a difference. Under a strong and active flame, which might subsequently burn out before the discovery of the body, there would be a degree of destruction in half an hour which a more slow and smothered combustion would not effect in several hours. In a recent case—the trial of Pel for the murder of his mistress, Böhmer (Paris, June, 1885)—experiments were made at the Morgue with the view of ascertaining within what period a body could be cremated, without nuisance, in an ordinary stove. It was found that a body weighing 132 pounds could be satisfactorily disposed of in 40 hours. It is from a want of due consideration of the facts relating to the burning of the body that some of the older medico-legal writers have given support to the hypothesis of *spontaneous combustion.* It has been supposed that in certain cases the dead human body has been destroyed more than appeared consistent with the fact of ordinary combustion from articles of dress or furniture; but this opinion has arisen from a want of sufficient experience on the effects of heat. Then, as the means by which the dress of a person had become ignited were generally destroyed with the body, it was thought that a human being might, under certain conditions, be consumed by fire spontaneously generated within him. This extravagant hypothesis has, however, found advocates in modern times. In March, 1850, a man named *Stauff* was tried at Darmstadt for the murder of the *Countess of Goerlitz.* He had assaulted the deceased in her chamber, and then set fire to the furniture with a view to conceal his crime. The body and dress were partially consumed. As the means by which the fire was applied were not at once apparent, and the assassin had locked the doors of the room, some medical men took up the theory that the deceased had died from spontaneous combustion. The facts of the case were referred to Liebig and Bischoff, and their report was issued in March, 1850, at which date the man Stauff was put on his trial. They found no difficulty in concluding that a murder had been perpetrated, and the body wilfully burnt *after death* for the purpose of concealing the crime. There was some doubt whether the deceased had died from strangulation, or from violence to the head. Stauff was convicted, chiefly on circumstantial evidence. He subsequently confessed that the countess had entered her room as he was in the act of committing a robbery. A struggle took place; he seized her by the throat, strangled her, and afterwards placed the body in a chair, piling around it combustible articles of furniture. He set fire to these, with a view of destroying the proofs of his crime. It was observed that the tongue of the deceased was protruded, as it is in violent strangulation, and that in its charred state it retained the position given to it by the act of murder. Other instances of alleged spontaneous combustion, if properly investigated, would have turned out to be cases of accidental or homicidal burning. (See Ogston's 'Lect. on Med. Jurispr.,' pp. 463, 558.)

Spontaneous combustion may take place in some kinds of vegetable and mineral substances, but not in the animal body, living or dead.

Amongst the questions which arise in reference to a body found dead from *burns* is this—whether the burns have been caused by gas, by inflammable vapours such as petroleum, or by gunpowder. Petroleum is at once indicated by its peculiar and powerful odour, and the sooty blackening of the parts burnt. (*Reg.* v. *Lee*, Exeter Ass., Jan. 1885.) In *Reg.* v. *Gaitskell* (Carlisle Spring Ass., 1872), the prisoner was convicted of manslaughter under the following circumstances. He poured a quantity of petroleum over the clothes of the deceased, and by accident the vapour caught fire, and the burns produced caused the man's death on the following day. Burns from petroleum, paraffin, kerosene, or any form of rock-oil, are generally of a severe kind. The clothes of a person readily imbibe the liquid, and by their fibrous structure act as a wick for spreading the combustion. There have been several cases in which men have been convicted of the murder of their wives by throwing at them a lamp in which petroleum was burning. The ignition of the dress has led to rapid death. Burns from the flame of gunpowder are generally characterized by blackening of the skin, and the introduction of some of the grains into the substance of the skin, producing the effects of tattooing.

Corrosive Liquids.—Among the cases in which medical evidence is sometimes required are those of throwing mineral acids, alkalies, or other corrosive liquids on the person. This crime was, and is, prevalent; and, until an alteration was made in the criminal law, there was no adequate punishment for it (24 & 25 Vict., c. 100, s. 29). On one occasion, an assailant escaped a charge of felony, because it could not be considered, in law, that sulphuric acid was capable of producing a *wound.* The statute above mentioned, while it punishes the offence, omits all reference to a definition of the word 'wound.' The nature of the liquid thrown is merely defined in general terms, to be 'any corrosive fluid or any destructive substance'—a point which will require medical evidence for its elucidation.

In common language, and according to the statute, the injury thus produced by a mineral acid, such as oil of vitriol, is called a burn, but it is wholly different in its origin as well as in its progress. Such an injury has, perhaps, never directly destroyed life; but great deformity and actual blindness have resulted. A medical man is sometimes required to distinguish these injuries from burns and scalds; this may be easily done, in the first instance, by the appearance of the part injured, as well as by the description of the first symptoms. The stain is brown when sulphuric acid has been used, and yellow when nitric or hydrochloric acid has been employed. The eschar, or destroyed, part is soft, and not dry as in a burn from a heated solid. The skin touched by a concentrated acid is destroyed, and sloughs away to the extent of the part on which the corrosive liquid was applied, leaving a suppurating and granulating surface. There is no capillary congestion or redness of the skin around the injury, as in a burn; but the colour of the injured part may throw some light upon the nature of the corrosive substance used. Articles of dress are also differently coloured by the various acids. The period at which a person may recover from an injury of this kind depends on its degree and extent, as well as on the part affected by the corrosive liquid. Although a person may not die from the direct effects of the acid, yet in irritable constitutions the inflammation which follows in deep-seated parts may prove fatal. In infants, or delicate nervous females, an extensive injury thus produced may readily destroy life. In one instance, sulphuric acid thrown on the face produced inflammation of the eye, for which bleeding was prescribed. The person died of phlebitis (inflammation of the vein), as the result of this bleeding.

The nature of the acid may be determined by applying wetted linen to the part, when the injury is recent, and examining the liquid thus absorbed. In general, however, evidence is readily obtained by examining the spots or stains left on articles of clothing or furniture. Oil of vitriol is most commonly used. The caustic alkalies may be used under these circumstances, as well as numerous other liquids, on which the only medical opinion required would be, whether the article employed should or should not be considered as a 'corrosive' liquid or a 'destructive' substance. To constitute a felony, it is not now necessary that the *person* should have sustained any bodily injury from the act of throwing the corrosive liquid. Unless vital reaction has taken place, there are no means of distinguishing the effects of a corrosive liquid on the living from those produced on the dead body. ('Ann. d'Hyg.,' 1859, t. 1, p. 396.)

The mineral acids are sometimes used in other ways for the destruction of life. A man poured a quantity of strong nitric acid into the ear of his wife while she was lying asleep. She awoke suddenly with a violent pain in the ear, which continued for three days, whereupon she became weak and exhausted. Soon afterwards there was copious bleeding, and a portion of membrane escaped. She lost the use of her right arm, and became completely deaf. Suppuration took place from the ear, and blood escaped daily. She gradually sank, and died six weeks after the injury, the right half of the body being convulsed before death. On inspection, a portion of the external ear was wanting, and the ear-passage was much wider than natural. The brain, near the petrous portion of the temporal bone, was softened, and the bone itself diseased (carious). The injury had led to death indirectly by producing disease of the brain. ('Lond. Med. Gaz.,' vol. xvii. p. 89.) In a case tried at Aberdeen, the evidence proved that a woman had poured oil of vitriol down the throat of her husband while he was lying asleep with his mouth open. She was convicted of the murder. In another case, a woman killed her husband by pouring a solution of corrosive sublimate down his throat while he was sleeping. These, however, were treated as cases of poisoning, as death did not depend on the local or *external* mischief produced by the corrosive agent employed.

ASPHYXIA.

DROWNING.

CHAPTER 38.

CAUSE OF DEATH.—SECONDARY CAUSES.—POST-MORTEM APPEARANCES.—MEDICAL PROOFS OF DEATH FROM DROWNING.—SPECIFIC GRAVITY OF THE BODY.—COINCIDENTAL CAUSES OF DEATH.—MARKS OF VIOLENCE.—ACCIDENTAL FRACTURES.—HOMICIDAL AND SUICIDAL DROWNING.

UNDER the term *Asphyxia* is included those forms of violent death in which the act of respiration is primarily arrested (p. 36). This comprises death from drowning, hanging, strangulation, and suffocation, and in this section the fatal effects of lightning, cold, and starvation will be considered. *Apnœa* is a term sometimes improperly applied for *asphyxia.*

The subject of asphyxia and the appearances presented by the body in this mode of death, have been fully considered at p. 36.

Drowning. Cause of Death. Asphyxia.—In drowning, asphyxia is produced by a physical impediment to the introduction of air into the lungs. The medium in which the person is immersed acts mechanically, and even more effectually than a rope or ligature round the neck; for, although air escapes from the lungs, and water penetrates into the minute air-tubes, yet no air can enter to supply the place of that which has already expended its oxygen on the blood. Hence this fluid must circulate, in the first few minutes after submersion, in a state unfitted for the support of life (unaërated); but the person lives, and is susceptible of recovery within a short interval. After the entire suspension of respiration, the action of the heart gradually slackens, and finally stops. It is at this period of the arrest of circulation that asphyxia passes into death. Asphyxia is determined by the period at which respiration is completely arrested; but the point of time at which death from drowning occurs is fixed by the moment at which the action of the heart ceases. This varies considerably, according to age, sex, state of health, and other circumstances.

When a person falls into water, and retains his consciousness, violent attempts are made to breathe: at each time that he rises to the surface a portion of air is received into the lungs, but, owing to the mouth being on a level with the liquid, water also enters and passes into the throat. A quantity of water thus usually enters the mouth, which the drowning person is irresistibly compelled to swallow. In his efforts to breathe while his head is below water, a portion of this liquid is drawn into the air-tubes and cells of the lungs. The struggle for life may continue for a longer or shorter period, according to the age, sex, and strength of the person; but the result is that the blood in the lungs is imperfectly aërated, the person becomes exhausted, and insensibility follows. The mouth then sinks altogether below the level of the water—air can no longer enter into the lungs; a portion of that which they contain is expelled, and rises in bubbles to the surface; an indescribable feeling of delirium, with a ringing sensation in the ears, supervenes; the person loses all consciousness, and sinks asphyxiated. In the state of asphyxia, while the dark-coloured blood is circulated, convulsive movements of the body take place, and the contents of the stomach are sometimes ejected by vomiting. There does not appear to be any sensation of pain, and, as in other cases of asphyxia, if the person recovers, there is a total unconsciousness of suffering during the period when the access of air was cut off from the lungs. The sensations of the drowned are stated to be by no means so acute as has commonly been supposed. A child thrown into the water by a nurse stated that she was conscious of sinking through the water till she felt her feet touch the bottom, and that she then fell asleep till she found herself rescued. (Case of *Reg.* v. *Redstone*, C. C. C., Feb. 1885; 'Brit. Med. Jour.,' 1885, i. p. 341.) One of the editor's colleagues at Guy's Hospital, who was drowned to the stage of insensibility, describes his sensations as having been by no means so fearful as might have been expected.

The successive phenomena of drowning have been divided into three stages by Bergeron and Montano. ('Ann. d'Hyg.,' 1877, t. 48, p. 332.) These authorities also state that the presence of a froth in the pharynx, larynx, and bronchial tubes is an invariable concomitant of death from drowning; that there is always a certain amount of congestion of the lungs, and sometimes this is accompanied by sub-pleural ecchymosis; and that the extent of the congestion and of the ecchymosis is always proportional to the efforts made at self-preservation.

Some persons who fall into water are observed to sink at once, without making any attempt to extricate themselves. This may arise either from sudden syncope or from the stunning produced by the fall. Should the person be intoxicated, or otherwise incapacitated, as by striking his head in falling, he may not again rise. These different conditions under which death may take place will sufficiently account for the difference in the appearances met with in the bodies of those who have died in water. A fatal result may be accelerated by the impression suddenly produced upon the skin, from the difference of temperature between the body and the water. To those who are not accustomed to water, a sudden immersion produces a great and rapid cooling of the surface, and forces the blood into the internal organs. There is difficulty of breathing, or severe spasmodic respiration, with giddiness and other symptoms, which may render a person powerless to extricate himself. The effect of cold on the skin is seen in the contracted state of the cutis in the bodies of those who have been drowned during the winter. It is calculated that in 25 per cent. of all who are drowned, the cause of death is pure asphyxia, and that in the remainder, syncope and cerebral congestion, amounting to apoplexy, may have a share in causing death.

In regard to the *time* required for death to take place by drowning, it may be observed that, when the mouth is so covered by water that air cannot enter, asphyxia comes on in the course of one or *two minutes* at the furthest, and the time at which this occurs does not appear to vary materially. Complete insensibility has supervened after one minute's submersion, and it is probable that in most cases a few seconds would suffice for the commencement of asphyxia. In this state a person can make no efforts to save himself, and death commonly ensues in from *two to five minutes.* The power of restoring life depends, not merely on the time that the body may have been submerged, but on the condition of the lungs at the time of its removal from the water. Experiments performed by a Committee of the Medico-Chirurgical Society have clearly proved that, as a form of asphyxia, drowning is not only more speedily fatal to life than ordinary suffocation, but, from the physical changes produced in the lungs by water the chances of recovery are lessened. The committee found that the difference in the results was not owing to exhaustion from struggling, from the violent efforts made to breathe, nor from the effect of cold in immersing the whole of the body, but to the introduction of water by aspiration into the minute air-tubes and cells of the lungs. This conclusion was derived from the following experiments. Two dogs of the same size were submerged at the same moment, but one had his windpipe plugged, so that no air or water could enter, while the other had not. After *two minutes* they were taken out together: the one with the windpipe plugged recovered at once, the other died. In three experiments dogs with their windpipes plugged were kept below water for *four minutes*: the animals recovered perfectly when removed from the water. ('Rep. on Suspended Animation, Med.-Chir. Trans.,' 1862, p. 449.) An inspection of the bodies at once revealed the difference. In animals simply deprived of air by plugging the windpipe, the lungs were merely congested; but in those which were submerged in their ordinary condition, the lungs, besides being more congested and showing ecchymosed points on the surface and in the substance, contained in their bronchial tubes a bloody mucous froth formed of water, blood, and mucus, which completely filled the small air-tubes. The violent respiratory efforts made by the animal before death, had caused the production of this froth, which formed a mechanical impediment to the entrance of air by the movements of the chest, as in respiration. This mucous froth or foam issued from the lungs on section, and appeared to penetrate their entire substance, which was saturated with water tinged with blood. The lungs were sodden with water, heavy, soft, doughy, retained an impression produced by the finger, and were incapable of collapsing. In the lungs of animals which recovered after a short submersion, little or none of this mucous froth was found in the air-cells. In the fatal cases, the quantity was great in proportion to the time of submersion. There is no doubt that this froth is produced by the violent efforts to breathe, which are made within a minute after submersion.

It may be inferred from these results that the power of recovery in human beings has a direct relation to the quantity of mucous froth in the air-tubes, and to the penetration of the substance of the lungs with water. The larger the amount of froth produced and the greater the penetration, the less the hope of recovery; for when the lungs have undergone these changes they are physically unfitted either to receive or expel air by respiration, and are incapable of collapsing. These circumstances will account for the fact that persons have been resuscitated in drowning under various and even opposite modes of treatment, and even under no treatment at all. It is right that every reasonable effort should be made to restore life, but if the lungs are sodden with water, their functions cannot be restored by any mode of treatment. The committee found that a complete submersion of *four minutes* effectually killed dogs, although, after removal from water, the heart continued to beat from four to five minutes. The continuance of the heart's action furnishes, therefore, no criterion of the power of recovery. A human being, as a rule, dies if submerged for a period of from four to five minutes. In a few exceptional cases, persons have been resuscitated after this period; but it is most probable that in them the lungs had sustained no physical damage. When the submersion has been short, the respiratory struggles below water slight, and the person has been treated immediately on removal, recovery is probable; but under opposite conditions, it is, with rare exceptions, hopeless.

Death from Secondary Causes.—Drowning may operate indirectly as the cause of death. Thus it has been repeatedly remarked that persons who have been rescued from water in a living state, and who have apparently recovered from the effects of submersion, have died, in spite of treatment, after the lapse of some minutes or hours; others have lingered for one or two days, and then have sunk, apparently from exhaustion. In those who perish soon after removal from water, death may arise either from exhaustion or from the obstruction of respiration by the penetration of water into the air-cells of the lungs. The case of *Colonel Mackenzie*, in 1873, furnishes an instance of rapid death from secondary causes. The colonel and a companion, while crossing a river, were carried away by the current. After much struggling, they both reached the bank in an exhausted state. The companion left the colonel apparently well, to procure assistance. On his return soon afterwards, the colonel was found dead. Death was attributed to apoplexy, but it was more probably due to exhaustion from over-exertion. A child, æt. 2½ years, was found floating on water. It was insensible, with gasping breathing, fluttering heart, no pulse at the wrists, tongue protruded and cold, water draining from the mouth and nose. Artificial respiration restored breathing, but not sensibility. Convulsions followed, lasting for two hours. These passed off. The breathing was natural and the body warm; temperature, 101·2° F. In this state the child continued seven hours, when difficulty of breathing suddenly came on, and the child died eighteen or twenty hours after removal from the water. Marcet states that spasm of the glottis has been among the severe secondary symptoms in persons who have been removed from water apparently drowned. A severe spasm of this kind manifested itself in one case while placing the patient in a warm bath. ('Med. Times and Gaz.,' 1857, i. p. 148.) When death takes place at a remote period, it may be caused by disease; and a question may thence arise, whether the disease was produced by the immersion in water or not. Such cases occasionally present themselves before our courts of assize.

Post-mortem Appearances.—The external and internal appearances produced by drowning vary according to the length of time during which the body has remained in water, and the period that has elapsed after its removal and before it is examined. Thus, in reference to the bodies of two persons drowned by a common accident, if one is removed and examined immediately, and the other is not removed from the water until after the lapse of several days and is then inspected, the appearances will be different. So, if the two bodies are removed at the same time, and one is immediately examined, while the other is not inspected until a month after removal, the proofs of drowning which may be discoverable in the former will probably have disappeared in the latter. A protracted exposure of the drowned body either to water or air, especially if the temperature is high, renders an inspection useless for the purpose of evidence.

External Appearances.—Supposing that the body has remained in the water only a few hours after death, and the inspection has taken place immediately on its removal, the *skin* will be found cold and pallid—sometimes contracted, under the form of 'cutis anserina.' This contracted state of the skin, when found, furnishes strong evidence of the body having gone into the water living. The skin is often covered to a greater or less extent by livid discolorations; the face is pale and calm, with a placid expression; the eyes are half open, the eyelids livid, and the pupils dilated; the mouth closed or half open; the tongue swollen and congested—frequently pushed forwards to the inner surface of the lips, sometimes indented or even lacerated by the teeth; and the lips, together with the nostrils, are covered with a mucous froth which issues from them. Kanzler has noticed in the male subject a remarkable retraction of the penis. In men who have gone living into the water, and been drowned, this appearance has been repeatedly observed by Casper and Kanzler; and the former states that he has not met with this condition of the male organ after any other form of death. In strong and robust men it has been found short, and strongly retracted into the skin. ('Ger. Leich.-Oeffn.,' ii. 109.) The body and limbs of a person recently drowned are usually found relaxed; but cadaveric rigidity appears to come on quickly in cases of drowning, and the body is often stiffened in the convulsed or distorted attitude which it may have had at the time of death. In a case observed by Beardsley, the body of a man who was drowned under ice was found with the arms stiffened in the attitude in which he was endeavouring to support himself on the ice.

Among the casual external appearances it has been noticed that the fingers and surface of the body occasionally present *abrasions*. Gravel, sand, mud, weeds, or other substances may be found locked within the hands or nails of drowned persons; for in the act of drowning, as common experience testifies, a person will grasp at any object within his reach, and in his efforts to extricate himself he may excoriate or wound his fingers. Substances floating in the water are also sometimes found in the nose, mouth, and ears. There are, however, many cases of drowning in which such appearances do not exist. There may be no substance for the drowning person to grasp; this will depend in a great degree upon the fact of the water being deep or shallow, of its being confined within a narrow channel or not, and many other contingencies. In all cases, when the person is unconscious before he falls into the water, or when his death is occasioned by syncope, he will be incapable of making those exertions which are necessary to the production of this appearance, and it is probable that this frequently occurs among women who are accidentally drowned. When the body has remained several days in water, the skin of the palms of the hands and soles of the feet is found thickened, white, and sodden, as a result of imbibition. This, coupled with the lividity appearing through the sodden skin, gives rise to the appearance known as the 'cholera hand,' met with, also, as the name implies, in epidemic cholera. Casper asserts that this condition may be produced by macerating a dead hand, if livid, in water.

Ogston, jun., summarizes the external signs of drowning thus: general pallor of the surface of the body, with bright rosy-red patches on the face and front of the neck chiefly, sometimes on other situations. Cutis anserina on the outer aspect of the thighs and arms, and about the top of the sternum. A blanched and corrugated condition of the skin of the hands, wrists, feet, and ankles, and not infrequently of the front of the knees and back of the elbows. This state of the hands may be accompanied by what has been termed the 'cholera hand,' where venous congestion shining through the bleached cuticle gives the hand a bluish appearance, like that observed in persons suffering from cholera. A white watery froth, like the lather of soap, at the mouth and nostrils, generally found when the body is seen in a fresh state and soon after its removal from the water; or a red bloody froth at these parts when the body is decomposed. Water, sometimes mixed with froth, flows from the mouth in quantity when the body is turned face downwards. The tongue may be protruded beyond, or pressed against, and marked by, the teeth. The penis may be erect, semi-erect, or retracted, and the scrotum shrunk and wrinkled. Sand or weeds may be found under the nails, or grasped in the clenched hands. Excoriations are not infrequently observed about the knuckles, or erosions on the hands, face, ears, &c., caused by fish or other animals in the water after death. Injuries of various kinds, cuts, bruises, evidently inflicted before death, which may complicate the diagnosis, may not infrequently be found. ('Edin. Med. and Surg. Jour.,' 1882, p. 865.)

Internal Appearances.—In a recently drowned body, the lungs and heart present the appearances usually indicative of asphyxia (p. 36, *ante*). The venous system is generally gorged with dark-coloured liquid blood. If death has not taken place from asphyxia, or if the body has remained a long time in water before an inspection is made, the lungs and heart will not present the characters about to be described. Some physiologists have asserted that the *blood* remains fluid in the bodies of the drowned; but more importance has been attached to this appearance than it really merits. Some observers have found the blood coagulated in the drowned. If the blood is found generally liquid, this may be due to the imbibition of water, or to putrefactive changes. Riedell found the blood in the heart and large vessels to contain coagula, in inspections made from two hours to five days after death. ('Lond. Med. Gaz.,' vol. xlvi. p. 478.) Hence it follows that the blood may be found either coagulated or uncoagulated in those who go into the water living, and die by drowning. Ogston, jun., gives the following as the internal signs of drowning: Water in the air-passages, lungs, gullet, stomach; and watery fluid in the pleural and peritoneal cavities. White watery froth in the mouth, throat, air-passages, and lungs, perhaps also in the stomach. Sand, &c., in these situations. Bulkiness or protrusion of the lungs, and over-distension or rupture of their superficial air-cells. Fluidity of the blood in the heart. Redness of the windpipe and gullet. In conjunction with these, the usual signs of asphyxia, namely, more blood in the right than in the left cavities of the heart; congestion of the lungs, liver, spleen, and kidneys; perhaps also congestion of the brain and the blood-vessels within the skull. ('Edin. Med. and Surg. Jour.,' 1882, p. 866.)

The *lungs* are sometimes congested, and more generally distended than collapsed. Casper and Kanzler found them, as a rule, much increased in volume, and completely filling the cavity of the chest, so that when the chest was opened they protruded out of it; but this did not depend on mere fulness of blood. The most accurate observations show, in recent cases of drowning, that the lungs are generally distended and in a flabby condition. Owing to the penetration of their substance by water, they have lost their usual elasticity, so that an impression made upon them by a finger is preserved, as in a dropsical limb. Riedell has pointed out this flabby and dilated condition of the lungs as a special characteristic of drowning; although they floated, he found that they were three or four times as heavy as in their natural state, owing to the water in their substance. ('Lond. Med. Gaz.,' vol. xlvi. p. 478.) On making a section of any part of the lungs, a bloody frothy liquid escapes—air and water being mixed together in the air-cells. These appearances are only likely to be observed in a well-marked form when the body is examined soon after death. The *windpipe*, *bronchi*, and minute *air-tubes* of the lungs, in a recently drowned body, are filled more or less with a *mucous froth* tinged with blood, as a result of the last violent efforts at respiration, when the mouth has sunk below the level of the water. This appearance is not always met with. Thus it has not been found in the bodies of those who have sunk at once below the surface and have not again risen to breathe. But from experiments on animals, made by the Committee of the Medico-Chirurgical Society, its presence in the air-passages does not depend on the fact of a person rising to the surface, although this may increase the quantity, but rather upon the violent spasmodic efforts made to breathe, under circumstances in which water alone can enter the lungs. These facts show that a mucous froth is produced in the air-passages even in two minutes, when there is entire submersion of the head; and its quantity appears to be in proportion to the length of submersion, and the violence of the efforts made to breathe.

The presence in the air-passages of a white, watery froth, frequently tinged with blood, may be regarded as a special character of asphyxia by drowning. When discovered in the lungs, associated with a watery condition of these organs, it furnishes a satisfactory proof of this mode of death. As its presence depends on the retention of air in thin vesicles diffused through the air-tubes, it is obvious that, except in recent inspections, *i.e.* within a few hours of death, it may have wholly or partly disappeared. Water passing in and out by the windpipe may destroy it—also the exposure of the body to a high temperature. This may account for the fact that it is not always observed in the inspection of the bodies of the drowned, when removed from water. Violent efforts at breathing may, however, produce it—especially if, owing to the loss of power of swallowing, any liquid should find its way into the windpipe. Independently of the presence of *water* (sometimes mixed with mud, sand, or weeds) in the larger air-tubes, a portion of this liquid is generally drawn into the lungs by convulsive efforts at respiration. It fills the cells and penetrates the substance of the organs, giving to them the flabby or doughy consistency already described. In some cases the contents of the stomach may be found in the windpipe and lungs: this occurs when a person has been drowned with a full stomach. Vomiting takes place, and the vomited matters are drawn into the lungs by the attempt to breathe. According to Tardieu, the state of the lungs is different from that observed in death from suffocation. He found great congestion of the lungs, but no subpleural ecchymoses. If these were present it would, in his opinion, indicate that the deceased had been suffocated before being thrown into the water. ('Ann. d'Hyg.,' 1855, t. 2, p. 307; also 1878, t. 2, p. 174.) According to Bergeron, ecchymoses (not punctiform) are sometimes present in cases of drowning, and the intensity of congestion and their extent are always in proportion to the struggles of the animal.

The state of the *heart* in the drowned has given rise to some discussion. In death from asphyxia, the right cavities generally contain blood, while the left cavities are either empty, or they contain much less than the right. Out of fifty-three inspections made by Ogston, the right cavities were found empty only in two cases, and the left cavities empty in fourteen. ('Lond. Med. Gaz.,' vol. xlviii. p. 291.) In a case of drowning which was examined by Bishop, the right side of the heart contained scarcely any blood; and in another case, the only medical difficulty regarding death by drowning presented itself in an emptiness or non-distension of the right cavities of this organ. The facts and observations accumulated by Chevers show that a full condition of the heart, although a common, is not an invariable concomitant of asphyxia, either from drowning or any other cause. ('Med. Jurispr. for India,' p. 441.) It has been elsewhere remarked that the action of the heart continues after the stoppage of respiration, and that the period at which this organ ceases to contract is variable. Hence in some cases there may be sufficient power in the right cavities to contract upon their contents, and to expel, more or less completely, the last traces of blood received from the body. Emptiness of the right cavities of the heart must not, therefore, be regarded as inconsistent with death from drowning; at the same time, it cannot be taken as a proof that the person has died from asphyxia. Riedell states that in half the number of instances which had fallen under his observation, the two sides of the heart contained equal quantities of blood; in the other half, the right side contained the larger proportion. In one case only the emptiness of the left side contrasted strongly with the fulness of the right.

A greater or less fulness of the vessels of the *brain* is described as one of the appearances met with in drowning; but this, when it exists, is probably a consequence of a congested state of the lungs. Some remarks have been already made on this subject, and from these it is evident that the state of the cerebral vessels can afford no presumption that death has taken place from drowning. In regard to the cases which we have had an opportunity of examining, the quantity of blood contained within the cerebral vessels has rarely been so great as to call for particular notice.

In examining the abdomen, it will commonly be found that the *stomach* contains water, which appears to enter into this organ by the act of swallowing during the struggle for life. This may be salt or fresh, according to the medium in which the drowning has taken place. The quantity is subject to great variation: sometimes it is large, at other times small, and in some instances no water whatever is to be met with. The absence of water may probably indicate a rapid death, as there could have been no power to swallow. Orfila has remarked that the mucous membrane of the stomach and bowels is occasionally much discoloured in drowned subjects. He observed also that, when drowning took place while the process of digestion was going on, the mucous membrane of the stomach often had a pinkish-red or violet tint. When the dead body had remained a long time in water, this membrane was observed to acquire a deep-violet or brown colour. A knowledge of this fact may be of some importance in those cases in which a person is suspected to have been poisoned previously to submersion. It has been said that the diaphragm is generally much raised towards the chest; but this may have depended on gaseous putrefaction, and the increase in the size of the abdomen by the formation of gas in the intestines. The urinary bladder in some cases contains urine, in others it is perfectly empty. Casper found it empty in one-half of the cases which he examined. It is obvious that the state in which the bladder is found must depend on its condition at the time at which the drowning occurred. (See, in reference to the appearances in the drowned, a paper by Ogston, 'Lond. Med. Gaz.,' vol. xlvii. pp. 763, 854, *et seq.;* also Riedell, 'Lond. Med. Gaz.,' vol. xlvi. p. 478; Casper, 'Ger. Leich.-Oeffn.,' vol. 1, p. 87; 2, p. 105; 'Klin. Novellen,' 1863, p. 523; and Ogston, jun., 'Edin. Med. and Surg. Jour.,' April, 1882, p. 865.)

Bergeron and Montano conclude, from their post-mortem examinations of drowned bodies brought to the Morgue in Paris, that the constant and certain sign of death by drowning is the presence of mucous froth, not only in the mouth, but in the larynx and bronchial tubes. There was always some degree of congestion, and occasionally of ecchymosis under the pleura, but this membrane never presented the dotted appearance seen after death from suffocation. The intensity of this congestion in animals drowned for experiment was in proportion to the struggles made by the animal. ('Ann. d'Hyg.,' 1877, t. 2, p. 332.) Ogston, jun., thus summarizes the post-mortem appearances in the drowned: when an external examination of the body only is allowed, if abundance of water pours from the mouth on turning the corpse face downwards, and if white watery froth is found at the mouth and nostrils, or if it be made to issue from them on compressing the chest, we may be justified in giving an opinion as to the probability of drowning, especially when the accessory signs, viz. rosy redness of the face and front of the chest, goose-skin, and bleaching and corrugation of the hands, are well marked, presuming always that no lethal injuries are seen on the body which would appear to have been inflicted before death, and no traces of corrosive action, &c., from poisons, be observable about the lips, hands, clothes, &c.; but that to justify us in giving a more positive opinion, we ought to have furnished to us a detailed account of the locality in which, and the circumstances under which, the body was observed before its removal to the place where it lies for examination. That where a complete inspection of the body is permitted, we may give a more positive opinion when, in addition to the external appearances, water in marked quantity, mixed with white watery froth, is found in the lungs and stomach, and also, perhaps, when a larger quantity of watery fluid is seen in the pleural cavities; when sand, seaweed, &c., are found in the bronchi, or even in the windpipe; when the lungs are bulky or protrude on the removal of the sternum; and when the blood within the heart is wholly fluid—especially when with these signs we find marked appearances of asphyxia in the heart, lungs, liver, &c. ('Edin. Med. and Surg. Jour.,' 1882, p. 873.)

Was Death caused by Drowning?—For a correct solution of this question, it will be necessary to consider the appearances met with in the drowned, and to determine how far they are characteristic of this form of death. Among the *external* signs of drowning, when the body is seen soon after death, are paleness of the surface, a contracted state of the skin (cutis anserina), and the presence of a mucous froth about the nostrils and lips. The absence of these appearances, however, would not prove that the person had not been drowned; for if the body had remained some time in water, or if it had been long exposed to air before it was seen by a medical man, the skin would undergo various changes in its condition and colour, and mucous froth would no longer be found adhering to the lips and nostrils.

State of the Skin.—The goose-skin, or cutis anserina, which is frequently observed in the drowned, shows that the skin possessed the living power of contractility at the time of immersion. Wagner suggests that the appearance might be produced in a dead body if thrown into cold water immediately after death, *i.e.* while the skin is warm. As none but assassins would be likely to resort to this proceeding, the objection would, if admitted, merely leave the fact of drowning still to be made out by an internal inspection. This contracted state of the skin could hardly be mistaken for a naturally rough or horny skin, as suggested by Casper. ('Ger. Leich.-Oeffn.,' vol. 1, p. 89.) As this condition of the skin is not invariably present, even in the recently drowned, its absence must not be taken to negative the hypothesis of drowning.

Substances grasped in the Hands.—Foreign substances, such as gravel, dirt, grass, or weeds, are sometimes found locked within the hands or lodged under the nails of drowned subjects. This fact may occasionally afford strong circumstantial evidence of the manner in which a person has died. If materials are found grasped within the hands of the deceased which have evidently been torn from the banks of a canal or river, or from the bottom of the water in which the body is found, we have strong presumptive evidence that the person died within the water. For although it is possible to imagine that the deceased may have struggled on the bank, and have been killed prior to submersion, yet in the value attached to this sign we are assuming that there are no marks of violence on the person, nor any other appearances about the body sufficiently striking to lead the examiner to suspect that death had occurred in any other way than by drowning. If the substance locked within the fingers or finger-nails is sand of the same character as that existing at the bottom of the river or pond, it is difficult to conceive any stronger fact to establish death from submersion. The abrasion of the fingers is a circumstance of minor importance; no value could be attached to this state of the fingers as an indication of a person having perished by drowning, unless it were in conjunction with the appearances above described. A witness would be constrained to admit, in many cases, that the fingers might become abraded or excoriated after death, or even before submersion; while in no case could he be called upon to make, in regard to substances found grasped within the hands, an admission which would invalidate the evidence deducible from this condition. This must, then, be regarded as a satisfactory proof of a person having been alive after his body was in the water. It is well known that, when two or three are drowned by the same accident, they are not unfrequently found clasped within each other's arms,—a fact which at once proves that they must have been living when submerged: so if a dead body is discovered still holding to a rope, cable, or oar, no further evidence is required to show that the deceased must have died from drowning. In 1877, the body of a gentleman was taken out of a pond on his own estate in Cornwall. His eye-glass was open and firmly grasped in his hand. There is reason to believe that he had fallen into the pond while looking at the fish.

The internal appearances upon which medical jurists chiefly rely as proofs of this kind of death, are—first, water in the stomach; and, second, water with a mucous froth in the air-passages and lungs.

1. *Water in the Stomach.*—Riedell found that, in the majority of cases of drowning, water passed into the stomach. In animals previously killed, and placed for twenty-four hours in water with the mouth wide open, no fluid penetrated to the stomach. ('Lond. Med. Gaz.,' vol. xlvi. p. 478.) Water commonly passes into the stomach of a living animal while drowning by the act of swallowing. It has been observed that, when an animal is stunned prior to submersion, water does not pass into the gullet, and when syncope occurs none will be found. As a proof that its entrance into this organ depends on the act of swallowing, it may be stated that the quantity in the stomach is greater when an animal is allowed to come frequently to the surface and respire, than when it is maintained altogether below the surface. The power of swallowing is immediately suspended on the occurrence of asphyxia, and in this way we may satisfactorily account for the difference observed in the two cases. The water thus found is in variable quantity; and there are some cases of drowning in which water is *not* present in the stomach. Water does not readily penetrate into the stomach of a body which has been thrown in after death; the sides of the gullet applying themselves too closely to each other to allow of the passage of fluid. If putrefaction has advanced to a great extent, some water may enter; but a medical man will easily judge, from the general state of the body, how far this process may have been concerned in the admission of fluid into the stomach and intestines. Orfila has suggested that water may be found in the stomach of a person apparently drowned, in consequence of this liquid having been drunk by the deceased, or artificially injected by another into the stomach after death. It is difficult to conceive under what circumstances the latter objection could be made, or what purpose it would answer; but in relying upon the presence of water in the stomach, it may be admitted that the deceased may have drunk water before his body was submerged. The mere discovery of water in the stomach, except under circumstances to be presently mentioned, is not, there-

fore, a necessary proof that it has been swallowed during the act of drowning.

It is, of course, presumed that the liquid contained within the stomach is of the same nature as that in which the body is immersed; for it is possible that fresh water may be found in the stomach of a person drowned in salt water, and in such a case it would be obviously improper for a medical witness to affirm, from the mere presence of water, that the person had died where his body was discovered. If the water contained mud, straw, duckweed, moss, seaweed, or any substance like those existing in the pond, river, or other water where the drowning occurred, this is a proof, when the inspection is recent, of its having been swallowed by a living person. The absence of water from the stomach cannot, however, lead to the inference that the person has not died from drowning, because in some instances it is not swallowed, and in others it may drain away and be lost after death before an inspection is made.

2. *Water with White Watery Froth in the Air-passages and Lungs.*—If the body is carefully removed from the water, and is examined soon after removal, these appearances, which furnish satisfactory evidence of death from drowning, will be found. Riedell regards the presence of a froth as a constant sign of this kind of death. In all his experiments and observations he states that he found a frothy fluid in the windpipe, bronchi, and lungs. After death it gradually disappeared from the air-tubes by exosmosis, but not from the lungs. The fluidity of this froth is, he contends, a distinctive character of death from drowning, and is not met with in any other case. ('Lond. Med. Gaz.,' vol. xlvi. p. 478.) These observations, made long since by Riedell, have been lately confirmed by others made at the Morgue by Bergeron and Montano. The existence of a froth in the fauces, larynx, and bronchi is, according to them, the only constant sign of death by submersion, whether syncope or asphyxia preceded death. They found it in animals narcotized previously to being thrown into water. The presence of a frothy fluid would undoubtedly show that liquid, from some cause, had penetrated into the air-passages; and when taken in conjunction with the presence of water in the substance of the lungs, it may be considered to furnish conclusive evidence of death from drowning. On the other hand, its absence does not necessarily prove that a person has not died from this cause. There may have been no convulsive efforts at breathing prior to death. A froth may not be found when the body has remained for a long period in the water after death, since by the free passage of this fluid into and out of the air-tubes, the froth, although formed in the first instance, may have disappeared. If, after removal from the water, the body is exposed to the air for several days before it is examined, it is rare that this appearance is seen. The froth may have been formed in the air-passages, but it may have entirely disappeared.

3. *Water and Foreign Substances in the Lungs.*—It has been elsewhere stated that, in the act of drowning, water is drawn with considerable force into the lungs, by violent attempts at inspiration. The aspiratory force thus exerted by the lungs is considerable. It has

been found that, when the heads of animals were plunged below mercury, some of this fluid, in spite of its great density, was actually drawn into the lungs, and globules of it have been found in the air-cells. *A fortiori*, this takes place in a greater degree with water which is forcibly drawn into and permeates the spongy texture of the lungs, rendering recovery more difficult, and death more rapid, than in other forms of asphyxia. This aspiratory force of the lungs has been measured, and is found, in small animals, to be equal to raising a column of mercury four inches in height. Not only is water thus drawn in, but sand, mud, weeds, or other substances floating in it are also carried into the air-tubes and cells of the lungs. When the water is mixed with weeds or mud, and water presenting the same admixture is found in the throat and stomach, this is strong evidence that the body has been plunged into the medium when the power of breathing and swallowing still existed, and hence that the deceased has been drowned. An attention to the condition of the stomach and lungs together will, therefore, be of importance in cases of alleged child-murder by drowning, since it may aid in proving or disproving the charge.

When a dead body is thrown into water, and has remained there some time, water with fine particles of sand, mud, or weeds, may pass through the windpipe into the lungs, and be there deposited. Water under these circumstances, however, does not penetrate into the substance of the lungs as by aspiration during life, and the amount which passes through the chink of the glottis is small. If simply an after-death effect, the water is found in the larger air-tubes unaccompanied by mucous froth. In most cases, however, the effect of aspiration as a result of living power is so manifest that the examiner can have no difficulty in forming an opinion.

A medical man may be occasionally required to express an opinion on the length of time that may have elapsed since the act of drowning, when the dead body of a person has been discovered in water. The rules which have been suggested for the guidance of a medical witness on these occasions are open to so many exceptions, owing to the different degrees in which putrefaction takes place in bodies exposed under similar circumstances, that they are of but little service as a basis for medical evidence. From these observations it will be perceived that the only characters on which reliance can be placed, as medical proofs of death from drowning, are—first, the presence of a mucous froth in the windpipe and air-tubes; second, of water in the air-tubes and air-cells of the lungs; and third, of water in the stomach. An early inspection of the body may thus enable a medical man to come to a satisfactory conclusion that death was or was not caused by drowning. The longer this inspection is delayed, the more ambiguous the evidence becomes, since the froth slowly disappears from the air-tubes, while water may penetrate into the lungs and stomach. The great cause of failure in obtaining medical proofs of drowning is generally the unavoidable delay before an inspection is made.

If, in examining a body taken from the water, we find upon it marks of violence, or severe internal injuries sufficient to destroy life, there is strong ground for suspicion. Why the body of a person who has really died from natural causes should be afterwards thrown into water it would not be easy to explain upon any hypothesis of innocence, but we can readily appreciate the motive when murderous violence has been used. After the lapse of five or six weeks, especially if the body has been removed from the water for the greater part of this period, none of the usual appearances of drowning will be met with; and in the present day, no practitioner would think of seeking for evidence under such circumstances.

In consequence of the uncertainty attendant on the appearances of drowning, legal ingenuity is often strained to the utmost to show that there is no certain *sign* of drowning, and therefore that the deceased must have died from some other cause. The general impression among non-medical persons appears to be that, whether in drowning or suffocation, there ought to be some particular *visible change* in some part of the body to indicate at once the kind of death; but it need hardly be said that this notion is founded on false views. A medical inference of drowning is founded upon a certain series of facts, to each of which, individually, it may be easy to oppose plausible objections; but taken together they furnish cumulative evidence as strong as is commonly required for proof of any kind of death.

In death from drowning, a question respecting the *specific gravity* of the human body may incidentally arise. In the healthy living body this is made up of the combined specific gravities of its different parts; so that, as in all heterogeneous solids, it is a complex quantity. The only part of the body which is lighter than water is fat. The specific gravity of this is 0·92, and it is calculated that the proportion of fat in an adult is about five per cent. of the weight of the body, or one-twentieth part. The specific gravity of muscle is 1·085, of brain 1·04, of the soft organs generally 1·05, of the lungs containing air 0·94, and of bone, the heaviest part of the body, 2·01. The lightness of the fatty portions is more than counterbalanced by the weight of the skeleton (about ten and a half pounds in the male, and nine pounds in the female), so that the naked human body, placed on water, has a slight tendency to sink. This tendency diminishes just in proportion to the quantity of the body immersed; because all those parts which are out of water, not being supported by water, become so much additional weight to the portion immersed. Hence the frequent cause of death by drowning. An inexperienced person exhausts himself by exertion, raises his arms continually out of the water, and as often sinks, owing to their weight having just so much effect on his body as if a leaden weight had been suddenly applied to his feet to sink him. When the *whole* of the living body is immersed, the specific gravity, owing to the expansion of the chest, differs so little from that of water, that a very slight motion of the hands or feet will suffice to keep a person on the surface. The head, owing to the weight of the bones of the skull, has always a tendency to sink below the level of water, and muscular force is required to keep it above the surface. Neil Arnott calculated, from the weight of water displaced, that the bulk of the adult body is equal to two and a half cubic feet. This is the quantity displaced by total immersion, and its weight is about 156 pounds. There are two circumstances which cause the specific gravity of the body to vary. If the quantity of *fat* is proportionably large, it will be diminished; and such a person will float more readily than another in an opposite condition. On the other hand, a large proportion of *bone* renders a person heavier than his bulk of water; and his body will sink more rapidly than that of another. These two modifying causes of buoyancy are liable to constant variation; hence the different accounts given by experimentalists relative to the specific gravity of the human body. The bodies of women are, *cæteris paribus*, of less specific gravity than those of men: the skeleton is smaller, and there is a greater proportion of fat—hence they more readily float. The bodies of infants and young children float with the greatest ease: the quantity of fat is usually in large proportion, and the bones are light—the earthy matter being not yet fully deposited. Thus, in infanticide by drowning, the body of a child that has fully respired rises very speedily to the surface—if, indeed, it does not remain altogether upon it.

If the lungs are emptied while the face is under water and the person cannot inhale again, the body remains specifically heavier than water, and will sink. Hence it follows that, *cæteris paribus*, a person with a large and capacious chest floats more easily than one whose chest is small and contracted. Hence, also, in a living person the body has a tendency to rise out of water during inspiration, and to sink during expiration—the quantity of water displaced under these two opposite conditions of the respiratory organs being very different. The entrance into water with the chest nearly emptied as the result of a loud scream or shriek is very unfavourable to the buoyancy of the body. The fact of *clothes* being on the person may also make a difference—either, from their nature, in serving to buoy up the body, or from their weight to sink it more deeply. Women are sometimes saved from drowning by reason of their clothes floating, and thus presenting a large surface to the water; it is partly owing to this circumstance that the bodies of drowned women often remain floating on the water immediately after death.

It may be laid down as a general rule, that the recently *dead* body unclothed is, when left to itself, *heavier* than water, and sinks when immersed. The expulsion of air from the lungs and their penetration by water, combined with the fact that the bones and all the soft parts, excepting the fat, are of greater specific gravity than water, offer a sufficient explanation of the sinking. After a variable period, generally not more than a few days, the body will rise again to the surface, and float. The period of its rising will depend—first, on the specific gravity of the body; second, on the nature of the water, whether salt or fresh; third, on the access of heat and air in facilitating putrefaction. If the gases generated find an escape, the body will sink; more gases may form, and then it will again rise, so that the sinking and rising may become alternate phenomena. A small quantity of air collected in the abdomen, as a result of putrefaction, will suffice for the floating of the body. Thus, taking the specific gravity of the dead body at 1·08 to 1·1, it would require but little air to keep it at or near the surface of the water. But a dead body, whether death has been caused by drowning or not, may not sink at all, owing to some one of the counteracting causes above mentioned. Several cases are reported in which the bodies of persons recently drowned have floated.

Marks of Violence on the Drowned.—The chief inquiry with regard to marks of violence on the bodies of the drowned is, whether they have resulted from accident or design. In forming an opinion, a witness must give due value to the accidents to which a body floating loosely in water may be exposed. Bruises or ecchymoses of considerable extent are sometimes seen on the drowned when the bodies have been carried by a current against mechanical obstacles in a navigable river or canal. If the deceased fell from a considerable height into water, his body in falling may have struck against a rock or projection, which may have produced extensive marks of violence. Dead bodies taken out of wells often present considerable marks of violence of a vital character when the deceased persons have fallen in accidentally or have thrown themselves in intentionally. The presence of these marks must not create a hasty suspicion of murder. It is manifestly impossible to lay down any specific rules for forming a decision in cases of this kind, since, probably, no two instances will be met with which will be perfectly similar in the details. In clearing up these doubtful points, everything must depend on the tact and experience of the practitioner who is called upon to conduct an investigation. There may be a severe cut in the throat arising from a previous attempt at suicide, as in the case of *Sands* (July, 1878), who destroyed his three children by cutting their throats, and then cut his own throat; but as the wound involved only the branches of the external carotid artery, he was able to walk to a pond about thirty yards away, in which his dead body was subsequently found. The first question which a medical jurist has to determine is whether the wounds or injuries on the body were produced before or after death. (See Wounds, *ante*, p. 234.) If after death, then they ought to be obviously of accidental origin. If the injuries show intentional violence, it will be proper to consider whether they are such as to be consistent with a suicidal attempt, or whether they indicate homicide. (See Wounds, *ante*, p. 251.) Men have been known to produce very severe wounds on the throat, resembling homicidal wounds, and still to have retained the power of throwing themselves into a pond or canal. A case of this kind was the subject of an inquest in 1877. In 1878, the dead body of a man was found in the Serpentine, with a bullet-wound traversing the chest in the region of the heart, likely to have caused immediate death. It was proved that deceased had been seen on the parapet of the bridge with a revolver, and that immediately after the report of a pistol, his body had been seen to fall over into the river. Thus were the facts readily explained. Care must be taken not to mistake the ravages of carnivorous animals, as rats, &c., on the dead body. The injuries thus produced have been mistaken for the results of acts of violence inflicted during life.

Accidental violence may sometimes be of so serious a nature that a practitioner might well doubt whether it did not indicate that the deceased had been violently treated prior to submersion. If a dead body were taken out of water, with one or more limbs dislocated, or the vertebræ of the neck fractured, and a surgeon was asked whether such injuries could be accidental and coincident with or consequent on drowning, the answer would probably be in the negative. But an instance has occurred in which both arms of a man were accidentally dislocated at the shoulders in the act of drowning, as the result of a fall into the water from a great height. The great point with regard to all marks of violence on the drowned is to throw light upon the questions—first, whether drowning was really the cause of death; and second, whether, if so, the act was the result of accident, suicide, or homicide. This last question does not concern a medical witness so much as a jury, who will determine it from the facts, medical and general, proved before them.

There is one case, of rare occurrence, in which a practitioner would be apt to be misled by trusting to appearances found on the drowned. If a dead body were removed from water with a deep ecchymosed circle round the neck, evidently produced by a cord or ligature, no traces of which could be found, it is not improbable that a strong suspicion would be raised that deceased had been murdered by strangulation, and the body afterwards thrown into water. A case occurred some years since in which a mark was produced on the neck of a woman who was accidentally drowned, as a result of the compression produced by the string of her cloak. Marks resembling those of strangulation have been produced on the necks of bodies floating in water, when soon after death they have been driven by a strong current against the stumps of trees or other obstacles in the stream. It might be said that, in cases of this description, circumstantial evidence would commonly show how the mark had originated. In admitting the truth of this observation, we must remember that circumstances, as matters of proof, do not always present themselves to our notice, or occur to our judgment, at the precise time that the law stands most in need of them. While, then, we use great caution in drawing an inference when there are such strong grounds for suspicion, we should not neglect to examine carefully the slightest appearances of violence on a body.

Fractures are not often met with in the drowned as the result of accident. Certain fractures likely to be followed by immediate death may forbid the supposition of their having occurred after drowning, and a careful examination of the body may show that they were not likely to have arisen from accident at or about the time of submersion. The medico-legal question has arisen whether fractures of the *vertebræ of the neck* can occur from accident alone, at or about the time of drowning. In 1858, a gentleman, in jumping from a bathing-machine head foremost into water more shallow than he had expected, caused a fracture and displacement of the cervical vertebræ, which led to death. A similar accident occurred in 1877. The deceased in this case dived, rose to the surface foaming at the mouth, and immediately sank. He was removed from the water and taken to St. Thomas's Hospital. He recovered consciousness, but lost all power in his limbs from his arms downwards. He soon died, and it was found that there was fracture and displacement of the vertebræ of the neck. The accident was caused by deceased's head coming in contact with the brick bottom of the bath. South quotes the case of a man who threw himself into a river to bathe from a height of seven or eight feet, the water being only three feet deep. He rose to the surface, but fell back senseless. When he recovered his consciousness, the account he gave of the accident was that he felt his hands touch the bottom of the river, but to save his head drew it violently back, upon which he lost all consciousness. He died in about ten hours, and on examination the skin of the back of the neck was much ecchymosed, the interspaces of the muscles were gorged, and the spinal canal was filled, with blood. The body of the fifth vertebra of the neck was broken across about the middle of its depth, and the two pieces were completely separated from the lateral parts. As there was no mark of contusion or dirt on the head, Reveillon, who reports the case, believes that the fracture arose from muscular action, and not from a blow received by striking the bottom; but this is doubtful. In another instance a sailor jumped headlong into the sea to bathe, a sail being spread three feet below the surface. He immediately became motionless, and died in forty-eight hours. The fourth and fifth vertebræ of the neck were found exclusively fractured, and the spinal marrow was crushed and lacerated. (Chelius's 'Surgery,' Part 6: Fractures.) In this case the fracture must have resulted from contact with the water or the sail; but as the latter was freely floating, this would be a yielding medium: hence this serious injury may occur accidentally in cases in which we might not be prepared to look for it. Delens has directed attention to fractures and other injuries found on the drowned bodies recovered from the Seine in Paris. Some of these have been wrongly referred to acts of murderous violence. ('Ann. d'Hyg.,' 1878, t. 2, p. 433.)

There is some reason to believe that cases of homicidal violence are frequently overlooked in the inspection of bodies found in water. (See 'Brit. Med. Jour.,' 1878, i. p. 96.) There is usually no post-mortem examination made for a coroner's inquest, the external inspection is hastily conducted, and the common verdict of 'found drowned' means simply found in the water.

Was Drowning the result of Homicide, Suicide, or Accident?—Drowning is a frequent cause of death. From a return made to the House of Commons in 1878, it appears that the total deaths by drowning in the inland waters of England and Wales during the year 1877 were 2662, —namely, 2140 males and 522 females. Of the 2662, 1423 perished in rivers or running waters, 637 in canals, and 602 in lakes or ponds. Although the question whether the act of drowning was the result of suicide or murder properly falls within the province of a jury, there are certain points in relation to it, which require to be noticed by a medical witness. In the first place, it is not to be imagined that an examination of the body will show any differences in either of the three supposed kinds of death. So far as the phenomena of drowning are concerned, they are the same, and they are accompanied by the same appearances after death in each case. In drowning which is accidental or suicidal, it is not usual, as it has already been observed, to meet with marks of violence on the person, except such as are purely of *accidental origin*, and have commonly been produced *after death*. In accidental drowning this is almost a constant rule; but if the person has fallen from any height, his body may be injured in the fall, either by projections on the banks of a river or canal, or by mere concussion on the water—allowance for either of which we must be prepared to make, according to the situation of the spot from which the person is supposed to have fallen.

The following curious case of supposed suicidal drowning, though the appearances might well give rise to a suspicion of homicide, was communicated to the editor by Lowndes, of Liverpool. It occurred in the autumn of 1884. The body of a girl, æt. 12½ years, was found floating in a canal, perfectly nude. The post-mortem examination led to the conclusion that death had resulted from drowning; the body had not been immersed more than twenty-four hours. On the middle of each thigh was an extensive wound, apparently of a post-mortem character, and attributable to the body having been injured by the lock-gates. There were no other wounds or bruises. The state of the genitals pointed to recent sexual intercourse; but the immersion of the body in water would have removed blood and semen. Several weeks later, the girl's clothes were found in the mud of the canal. They bore evidence of rough usage, the sleeves of the jacket being torn off—one being turned inside out, and the other being missing. It was thought that the clothing might have been washed off by a powerful sluice of water. The sexual intercourse was consistent with the lewd habits of the deceased.

It is calculated that in England drowning is the cause of death in nearly one-half of all suicides; but this, of course, will vary according to localities. In *suicidal* drowning we have a difficulty to encounter which we do not meet with in that which is *accidental*. A man may have attempted suicide by some other means previous to throwing himself into the water; thus, then, besides the accidental violence of accidental drowning, we may meet with violence on the person, evidently indicating wilful perpetration. What is the nature of this violence? Is it to be defined? Can it always be distinguished from that which is positively *homicidal?* The answers to these questions must depend on the circumstances proved in each case.

Drowning in Shallow Water.—Homicide has been sometimes presumed from the peculiar circumstances under which a body has been discovered. Thus, for instance, it has been a debated question whether a person intent on suicide can voluntarily drown himself in *shallow* water, as in a bath, by turning upon his face and retaining this position with his mouth below the level of the water. This question has been long since settled in the affirmative by the occurrence of well-authenticated cases. It appears to have been raised originally on the theoretical view that the resolution of a suicide would fail him in such a situation, and that, having the means of escape, he would lose no time in extricating himself. It need hardly be stated that the mere immersion of the mouth in water not more than a few inches deep will produce all the phenomena of death by drowning; with the exception that little or no water would probably be found in the stomach. A man may thus die in two or three minutes. Devergie mentions an instance where a man was found drowned in a small stream, his face towards the ground, and his head just covered by the water, which was not more than a *foot* in depth. On dissection, there were all the appearances of drowning present, and a large quantity of sand and gravel was found occupying the windpipe and smaller air-tubes. In 1874, a drunken man fell with his head across a shallow ditch. He was found dead, and it was obvious that his body had so dammed up the water that it had flowed over his face, and thus caused his death by drowning. He was powerless to save himself. A woman committed suicide by breaking a hole in the ice of a pond during the winter, and thrusting her head into the water, the rest of her body being out. A man was found dead with his face downwards in a small stream of water only six inches deep. The water was so shallow that it did not cover the deceased's body or his head. There was clear evidence that this was a case of suicidal drowning.

Although a person has for a short time the power of removing from a position in which he must speedily die, that power is soon lost. If the mouth is kept below water by a strong voluntary effort for half a minute or longer, the unaërated blood is circulated through the brain, and the person becomes powerless, so that his fate is not now in his own hands. Lunatics and other persons have thus destroyed themselves in shallow baths, although left unwatched by the attendant for only four or five minutes. The discovery of dead bodies under these circumstances is, therefore, quite consistent with suicide, but it does not necessarily prove that the act was suicidal. It cannot be denied that a person, if young or enfeebled by disease or age, may be held by others in such a position sufficiently long to produce death from drowning, but if he is capable of making resistance, we ought to find some marks of violence on the limbs or body. So, again, such a position is by no means incompatible with accidental drowning; and on this it may happen that a medical practitioner will be called to express an opinion. A man in a state of intoxication, or when suddenly attacked by syncope, epilepsy, or apoplexy, may fall with his face in a gutter, ditch, or small pool of water; and he may die in this position, not having the power to extricate himself. Even marks of violence on the body must not be too hastily construed into proofs of murder. Some years since a case of this description gave rise to a trial for murder in one of the midland counties. A man was found dead with his face in some melted snow, and there were several severe contusions on his body.

The evidence showed that, after a quarrel, he had left a neighbouring inn much intoxicated; and it was rendered probable that he had perished accidentally on his way home. There was no reason to suppose that he had been murdered. Infants, from mere helplessness, may be drowned under similar circumstances; but at the same time, an assassin may select this mode of destroying life in order to give the appearance of accident.

Death from Partial Immersion.—There is no doubt that murder by drowning may be perpetrated without the *whole of the body* being immersed in water. A case of this kind, which was the subject of a criminal trial, occurred in 1841 (*Reg.* v. *Yaxley*, Norwich Lent Ass.), and the prisoner was convicted. It appears that the mode in which the prisoner destroyed her infant child was by immersing its head for a few minutes in a pail of water. She removed it before it was quite dead; but it soon died, after slight convulsive movements of the limbs. The case was rendered obscure by the fact that the whole of the body had evidently not been immersed; and the only conceivable means of drowning were in a small duck-pond adjoining the house, which was covered with weeds; but no weed was found in the stomach of the child, although a quantity of water was there present.

Suicide by drowning may take place as the result of partial immersion—the immersion of the head. Several cases of this kind have occurred. In 1877, a Mr. Stagg, of Birmingham, was found dead with his head downwards in a water-butt, and his legs protruding over the top. In 1877, a woman was found dead in London; she was in a stooping position on the floor, and her face downwards in a pail of water. In 1878, a woman was found dead with her head immersed in a water-tank only a foot wide; she had so placed her head that it was under the bar of the ball-tap. These cases show determined acts of suicide. On several occasions, however, persons, whilst examining water-cisterns have fallen into them, and perished accidentally—the head only being immersed.

Ligatures on the Hands and Feet.—When a drowned body is removed from water with the hands or the hands and feet bound with cords, it is usually considered that we have therein presumptive evidence of homicide; but numerous cases are recorded in which suicides have actually bound themselves in this manner, or have attached heavy weights to their bodies, before throwing themselves into water, for the express purpose of preventing any chance of their escaping death.

HANGING.

CHAPTER 39.

CAUSE OF DEATH.—DEATH FROM THE SECONDARY EFFECTS.—POST-MORTEM APPEARANCES.—MARK OF THE CORD OR LIGATURE.—WAS DEATH CAUSED BY HANGING?—HANGING AFTER DEATH.—SUMMARY OF MEDICAL EVIDENCE.—MARKS OF VIOLENCE ON THE HANGED.—WAS THE HANGING THE RESULT OF ACCIDENT, SUICIDE, OR HOMICIDE?—THE POSITION OF THE BODY.

Cause of Death. Asphyxia.—By hanging we are to understand that kind of death in which the body is wholly or partially suspended by the neck and the constricting force is the weight of the body itself, while in strangulation the constricting force is due to some other cause. In both cases death commonly results from *asphyxia* (p. 36), although this must depend in a great measure upon the position of the ligature on the neck as well as on the degree of pressure produced. If the cord is loose, or applied to the upper part of the neck, a small quantity of air may still reach the lungs, and then the cerebral circulation may become interrupted by the compression of the great vessels of the neck. In this case apoplexy of the congestive kind is induced, and operates as the immediate cause of death. It is easy to conceive that there may be a mixed condition of asphyxia and apoplexy, and according to the observations of Casper and Remer, this is actually met with in a great number of cases of death from hanging. A man, æt. 57, committed suicide by hanging. After being suspended for an hour, he was cut down. As the doubled rope was slackened from the neck, air escaped through the larynx, and a prolonged, rather loud groan was heard. As an explanation, Holland suggests that the suicide, in hanging himself, drew in a deep breath, and the sudden and violent constriction of the neck retained the air in the chest until the ligature was removed. ('Brit. Med. Jour.,' 1875, i. p. 575.)

In the execution of criminals, death takes place at different intervals of time after suspension. This difference is probably dependent on the greater or less degree of constriction produced by the ligature. If the rope should press upon the larynx or above this organ, the closure of the air-passages will not be so complete as if pressed upon the windpipe immediately below the cricoid cartilage. A slight degree of respiration might in the former case continue for a short interval, by which the life of a person would be prolonged, while, in the latter, death would be immediate. If the windpipe is in part ossified, the pressure of the ligature is less perfect, and death will then take place more slowly. Louis found that an occasional cause of death in hanging was a displacement of the second vertebra of the neck, whereby the spinal marrow was suddenly compressed. As a general rule, this cause of death is only likely to be observed in corpulent or heavy persons, when a long drop is given, and when much violence has been at the same time employed by the executioner. Fractures of the vertebræ may occur and prove fatal by compressing the spinal marrow. Death may also be caused suddenly, by cerebral congestion from pressure on the blood-vessels, or by the effusion of blood on the spinal membranes. This is likely to happen when the head falls, or is bent suddenly backwards, so that the weight of the body is supported on the back of the neck.

Death from hanging appears to take place very rapidly, and without causing any physical suffering to the person. It is observed that in those criminals who are executed, there are sometimes violent convulsions of the limbs and trunk. There is no reason, however, to believe that the individual suffers pain, any more than in the convulsions of an epileptic fit. On recovery there is an entire loss of consciousness of pain in both cases. The circulation of dark-coloured blood through the brain and spinal cord may account for these effects. Efforts to inspire are made for one or two minutes after the closure or compression of the windpipe. The diaphragm and intercostal muscles act spasmodically, but no air enters the lungs; and it is probable that in the act of hanging, part of the air contained in the organs is convulsively expelled. When the suspension of the body has only continued a few minutes, it has often been found impossible to restore life; and indeed, the period at which resuscitation may take place varies according to circumstances. Supposing the hanging to be unattended with violence to parts about the neck, some persons might be resuscitated after five minutes' suspension or longer, but then it has been observed that they have subsequently died from secondary causes affecting the brain and nervous system. Others, again, may not be recovered when they are cut down immediately after suspension—a fact which depends probably on the different degrees to which asphyxia or apoplexy has extended. When the ligature is so placed as to press on the windpipe below the larynx, insensibility and death are almost instantaneous.

Patenko has recently investigated asphyxia due to mechanical causes, and draws a clear distinction between the appearances met with according as the access of air is shut off at the end of an expiration or at the end of an inspiration. He shows that, if a dog be hanged, the drop taking effect as expiration is completed, the efforts at inspiration results in engorgement of the lungs; whereas if the drop takes effect at the moment when inspiration is completed, the lungs are comparatively bloodless. ('Ann. d'Hyg.,' 1885, t. 1, p. 209.)

Death from the Secondary Effects.—It by no means follows that, because we have succeeded in restoring the respiratory process, a person is safe. Death may take place by a fatal relapse at various periods after the accident. A case of this description has been published by Brodie. A boy, æt. 17, was found hanging. When cut down he was insensible, his face livid, his lips of a dark purple colour, the pulse not perceptible, the pupils dilated and motionless. Artificial respiration was used, and in a quarter of an hour the diaphragm began to act. He breathed at irregular intervals with stertor, and with a rattling noise in the throat. The pulse became perceptible, but often flagging, and the surface of the body was cold. The countenance was still livid, but the pulse and breathing had improved. At the end of another hour, an attempt was unsuccessfully made to take some blood from the arm, and the patient was placed in a warm bath. The breathing was stertorous through the night, and in the morning twelve ounces of blood were taken from the arm; but there was no relief. He continued insensible, and cold on the surface; there was frothing at the mouth, and he died twenty-four hours after he was cut down. The body was carefully examined. The vessels of the brain were very full of blood: this was the only morbid appearance.

We learn from those who have been resuscitated, as well as from experiments performed by persons upon themselves, that the insensibility of asphyxia comes on in the most insidious manner in death from hanging, and that a slight constriction of the windpipe will speedily produce loss of consciousness and muscular power. ('Devergie,' 2, 370.) The only symptoms of which the hanged persons have been conscious were a hissing in the ears, a flash of light before the eyes, then darkness and oblivion. The only profitable inference, in a medico-legal view, which can be drawn from observations of this kind is that asphyxia is not only rapidly induced, but that it supervenes under circumstances where it would not be generally expected to occur—*i.e.* when the weight of the body is in great part supported. Fleischmann found that a cord might be placed round his neck between the chin and hyoid bone, and tightened either laterally or posteriorly without perceptibly interrupting respiration; but while the respiratory process was thus carried on, his face became red, his eyes prominent, and his head felt hot. These symptoms were followed by a sense of weight, a feeling of incipient stupefaction, and a hissing noise in the ears. On the occurrence of this last symptom, the experiment, he says, should be discontinued, or the consequences may be serious. His first experiment on himself lasted two minutes; but in the second, owing to the cord by its pressure more completely interrupting respiration, the noise in the ears appeared in *half a minute*. When the pressure was applied on the windpipe, the effect was *instantaneous*, but when on the cricoid cartilage it was not immediate. If it was applied between the hyoid bone and the thyroid cartilage, or on the hyoid bone itself, the period during which a person could breathe was extremely short; and this result was more striking when the act of expiration was performed at the moment of applying the pressure.

The death of *Scott*, the American diver, in 1840, shows how readily asphyxia may be induced by a slight compression of the throat, even when a person might be supposed to have both the knowledge and the power to save himself. This man was in the habit of making public experiments on hanging, and had frequently before gone through them without danger; but on the last occasion, it is probable that a slight shifting of the ligature from under the jawbone caused so much compression on the throat between the chin and larynx as speedily to produce asphyxia. No attempt was made to save him until it was too late, and he was not brought to a hospital until thirty-three minutes had elapsed. He was allowed to hang *thirteen minutes*, the spectators thinking that the deceased was only prolonging the experiment for their gratification. The very insidious and painless manner in which a person who is suspended passes from life into death is also well illustrated in the report of the case of *Hornshaw*. ('Lancet,' 1847, i. p. 404.) This man was on three occasions resuscitated from hanging —a feat which, like Scott, he had performed in London for public gratification. He stated that on the last occasion he lost his senses almost at once; it seemed as if he could not get his breath, and that some great weight was attached to his feet: he felt that he could not move his hands or legs to save himself, and that the power of thinking was gone. It is not improbable that many persons have thus lost their lives by privately attempting these experiments, and their cases have been wrongly set down to acts of suicide. There is reason to believe that boys have thus frequently but unintentionally destroyed themselves, from a strange principle of imitation or curiosity. In 1874, a boy, æt. 11, in order to frighten his parents, tied a knot in his handkerchief, and put one part of it over the knob of the upright at the foot of the staircase, and the other underneath his chin, so that the ligature did not go round his neck. His dead body was found suspended in the loop, which had pressed against the windpipe and produced speedy unconsciousness. He died quietly, without struggling.

Post-mortem Appearances.—The *external* appearances met with in the hanged have been generally taken by medico-legal writers from those seen in the bodies of criminals who have been executed, or those who have been violently hanged. Thus among them are the following: lividity and swelling of the face, especially of the lips, which appear distorted; the eyelids swollen, and of a bluish colour; the eyes red, projecting forwards, and sometimes partially forced out of their cavities; the tongue enlarged, livid, and either compressed between the teeth or sometimes protruded; the lower jaw retracted, and a bloody froth about the lips and nostrils. There is a deep and ecchymosed impression around the neck, indicating the course of the cord, the skin being occasionally excoriated; laceration of the muscles and ligaments in the hyoideal region; laceration or contusion of the larynx, or of the upper part of the windpipe. There are also, commonly, circumscribed patches of ecchymosis, varying in extent, about the upper part of the body and the upper and lower limbs, with a deep livid discoloration of the hands; the fingers are generally much contracted or firmly clenched, and the hands and nails, as well as the ears, are livid; the urine, fæces, and spermatic fluid are sometimes involuntarily expelled at the moment of death. Such appearances will rarely be found in those cases of suicidal hanging which are likely to come before a medical practitioner. In these, the face is generally pale, and the mark on the neck is a simple depression in the skin usually without ecchymosis, and acquiring a horny or parchment colour only after some time. Esquirol found, in one instance, that when the body was examined immediately after death, the face was not livid; but it first began to assume a violet hue in eight or ten hours. He thought that, when the cord was left round the neck, the face would be livid, but if removed immediately after suspension, pale. This view is not, however, borne out by observation. The tongue is not always protruded. Devergie found that there was protrusion of this organ in eleven cases out of twenty-seven. This protrusion was formerly supposed to depend upon the position of the ligature: thus it was said, when this was below the cricoid cartilage, the whole of the larynx was drawn upwards, and the tongue carried forwards with it; while, when above the hyoid bone, the tongue was drawn backwards. The protrusion or non-protrusion of the tongue does not depend upon any mechanical effect of this kind, but simply upon congestion; for it is occasionally met with thus protruding in cases of drowning and suffocation. Besides, the protrusion has not been found to have any direct relation to the position of the ligature.

There is another appearance on which a remark may be made—namely, the state of *the hands*. As a general rule, in violent hanging or strangulation, the hands are clenched. This appearance may not always be found, as it may exist and be destroyed before the body undergoes medical inspection. When the constriction of the neck is produced suddenly, and with great violence, we may expect to meet with it. Thus it is found in the cases of executed criminals, and in strangulation attended with great violence, whether the act be due to homicide or suicide. In cases in which the constriction is gradually produced, the clenched state of the hands may not be found. Convulsions generally attend violent hanging or strangulation. The influence of these on the attitude or dress may not be apparent unless the body is in a sitting position or lying down.

Internally, we meet with the appearances of asphyxia—*i.e.* engorgement of the lungs and venous system generally with dark-coloured fluid blood; the lungs otherwise present no particular appearance. In the case of an executed criminal they were in a state of extreme collapse. ('Lancet,' 1867, ii. p. 576.) This is an unusual appearance. The right side of the heart, and the great vessels connected with it, are commonly distended with blood. But when the inspection has been delayed for several days, this distension may not be observed. The mucous membrane of the windpipe is more or less congested, and is sometimes covered with a fine bloody mucous froth. This may be owing to imperfectly obstructed respiration, and to spasmodic efforts at breathing. The vessels of the brain are commonly found congested; and in some rare instances it is said extravasation of blood has been met with on the membranes or in the substance of the organ. Effusion of blood is, however, so rare that Remer found this appearance described only once among one hundred and one cases; and in one hundred and six cases recorded by Casper, it was not found in a single instance. In one case Brodie found a large effusion of blood in the substance of the brain, and he refers to another case in which there was a considerable effusion between the membranes. ('Lect. on Pathology,' p. 58.) The venous congestion of the cerebral vessels is, however, rarely greater than in other cases of asphyxia, and is probably dependent on the degree in which the lungs have become engorged. In most instances there is increased redness of the substance of the brain, so that, on making a section of the hemispheres, a greater number of bloody points (puncta cruenta) than usual will appear. The kidneys have been found much congested. A more important circumstance has been noticed by Yellowly—namely, that in examining the stomachs of five criminals who had been hanged, he found great congestion in all, while there was blood coagulated upon the mucous membrane in two. Such an appearance might, it is obvious, be attributed in a suspicious case to the action of some irritant substance. (See p. 66; and 'Ann. d'Hyg.,' 1830, p. 166; 1835, p. 208; 1838, p. 471.) In the case of *Good*, who was executed, the stomach was found on inspection to present over its whole surface a well-marked redness, resembling the effect produced by an irritant poison. The redness was especially observed at the pyloric end, where it assumed a somewhat striated character. A drawing representing the appearance of the interior of the stomach is preserved in the Museum of Guy's Hospital. In another case the stomach and intestines, especially the inner coat of the former, were much congested and inflamed, as if the man had died from poisoning. The contents of the stomach were analysed, but no poison was found. Chevers, who quotes this case, states that he has more than once verified Yellowly's observation, and has found the mucous membrane of the stomach much congested in death from hanging. ('Med. Jurispr. for India,' p. 397.)

The most striking external appearance, however, is the *mark* produced on the neck by the cord or ligature. The skin is commonly depressed, and sometimes ecchymosed, but rarely throughout its whole extent; it is frequently free from all traces of discoloration as the result of ecchymosis, the skin in the depression being then hard, brown, or of a *parchment colour and consistency*; or there may be only a thin line of blue or livid colour in the upper or lower border of the depression, and chiefly in front. The course of the mark is generally oblique, being lower in the fore part than behind, and it is often interrupted. It is most commonly above the larynx. If the noose should happen to be in front, the mark may be circular, the jaw preventing the ligature from rising upwards in the same degree before, as it commonly does behind. The mark is generally single, but we may meet with it double, as when the ligature has been formed into two circles or loops previously to its application. Its other characters will depend upon the nature of the ligature employed. Thus a large and wide ligature rarely produces ecchymosis,—the mark is wide and superficial; but a small ligature produces a narrow and deep depression, sometimes accompanied with abrasion of the cuticle and effusion of blood beneath the skin. The ligature or cord should always be examined for blood, hair, or other suspicious substances.

It was formerly believed that the mark on the skin produced by the cord was invariably discoloured from effusion of blood, or ecchymosis; but more correct observation has shown that this condition is an exception to the general rule. When ecchymosis does exist, it is commonly superficial and of slight extent. There is rarely, if ever, effusion of blood in the cellular tissue. In the bodies of criminals who have been executed, it is not unusual to find ecchymosis, but even here it is not always present, or only in front of the neck. Riecke found only once in thirty cases an effusion of blood beneath and on both sides of the depression produced by the ligature. The tongue was generally between the teeth, and in most cases wounded by them. He attributed death to stretching of the spinal marrow. (Henke's 'Zeitschrift,' 1840, 27 Erg. H. 332.) In a case which the author had an opportunity of examining, there was only a slight trace of ecchymosis in one spot where the knot in the cord had produced contusion. That it should occur in criminal executions is not surprising, considering the violence employed on these occasions; but it has been somewhat too hastily assumed that the appearances found in executed criminals are met with in all cases of death from hanging. King, in examining the neck of an executed criminal, did not discover the smallest effusion of blood in the course of the cord, although in this case the body had been allowed to fall from a height of seven feet and a half, with a fearful jerk. ('Dub. Quart. Jour.,' Aug. 1854, p. 86; and 'Cases of Ruptured Intestine,' 1855, p. 12.) The theory of the production of ecchymosis has been carried so far that a *livid mark* in the course of the cord was formerly said to be the best criterion for distinguishing hanging in the living from hanging in the dead body. This statement, however, is not in accordance with facts. In a large number of cases the skin, instead of being blue or livid, or presenting an effusion of blood in the cellular tissue beneath, is hard and of a yellow colour, resembling parchment. It has that appearance which the cutis commonly assumes when the cuticle has been removed from it two or three days; and, on dissecting it, the cellular membrane beneath often appears condensed and of a silvery whiteness. Chevers states that in cases of death from hanging he has not met with any ecchymosis in the skin along the course of the mark. (Op. cit., p. 406.) The editor can confirm this observation. In some instances the mark has presented itself simply as a white depression; this has been chiefly observed in fat subjects. The observations of Casper on this point were that in two-thirds of all the cases examined, ecchymosis was entirely absent. He also found that there was no difference in the appearance whether the ligature was removed sooner or later after death.

Injuries to the muscles and deep-seated parts of the neck are, of course, only likely to be seen when considerable violence has been used in hanging. It is now customary in criminal executions to give a long drop to the body, *i.e.* from six to eight or more feet. Under these circumstances, the muscles of the neck are found bruised and lacerated. In two instances the head was wrenched off. The sterno-cleido mastoid muscle has been found torn through, and its ends nearly two inches apart. In other instances the lining membrane of the common carotid artery has been found lacerated. Congestion and swelling of the genital organs in both sexes have been set down among the common consequences of hanging; but many observers have not met with these conditions, and it is doubtful whether, unless the body is examined speedily after suspension, any marked difference would be discovered. A more common sign, perhaps, is a discharge from the urethra in the male, by a spasmodic action, at the moment at which death takes place. It appears that no reliance can be placed upon evidence derivable from this appearance, and yet it has sufficed to give rise to a violent controversy among French medical jurists. ('Ann. d'Hyg.,' 1839, t. 1, pp. 169, 467; t. 2, p. 393; 1840, t. 2, p. 314.) Unless death from hanging is strongly established by other facts, neither the examination of the linen of the deceased, nor the application of the microscope to the mucous fluid found in the urethra, would be of any practical value in elucidating the question—at least to the satisfaction of an English jury. In a criminal execution which took place at Dublin, in which there was a fall of fourteen feet, the head was severed from the body. There was no dislocation of the vertebræ. The atlas was intact, but the axis was fractured. The blood flowed from the head in greater quantity than from the body. The carotid arteries continued to bleed at intervals for five minutes after death. ('Lancet,' 1871, i. p. 166; ii. 210.)

The following may be regarded as a summary of the appearances in hanging, when death has really taken place from asphyxia: the countenance is either livid or pale; the eyes are prominent; the tongue congested and occasionally protruded; the lower jaw retracted; the skin is covered with patches of cadaveric lividity; the hands are livid and clenched; an oblique mark is found on the neck, sometimes presenting traces of ecchymosis; commonly, however, the skin is only brown in colour and hardened; the larynx, windpipe, and subjacent muscles are lacerated, depressed, or discoloured; the vessels of the brain are congested, as well as those of the lungs and the right cavities of the heart; a mucous froth tinged with blood is occasionally found in the windpipe. These appearances will, of course, be modified, or they may be altogether absent, when death has arisen from disorder of the cerebral circulation, or from injury to the spinal marrow, either by great congestion, effusion of blood, fracture, or displacement. Patenko describes intense congestion of the medulla oblongata as an appearance found in death from hanging. ('Ann. d'Hyg.,' 1885, t. 1, p. 209.)

Was Death caused by Hanging?—When a person is found dead and his body is suspended, it may be a question whether death really took place from hanging or not. In investigating a case of this kind, it is necessary to draw a distinction between the *external* and *internal* appearances of the body. The former alone can assist us in returning an answer to this question: the internal appearances of the body can furnish only the general signs of asphyxia, and enable us to say whether any latent cause of death existed or not.

The Mark of the Cord.—Among the external appearances, it is chiefly to the *mark* produced by the cord on the neck that medical jurists have looked for the determination of this question. As the form, position, and other characteristics of this mark have been already described, it will now be necessary to allude to it only as furnishing evidence of life at the time of its production. It has been stated that, so far from being constantly livid or ecchymosed, this condition is in reality not seen in more than one-half of the cases which occur. But admitting that we find ecchymosis in the course of the ligature, are we always to infer that it must have been applied while the person was living? There are numerous cases which show that the presence of active life is not necessary for the production of ecchymosis in the mark; and from the experiments of Devergie, it would appear that, if a body is hanged immediately or a short time *after death*, an ecchymosed mark may be produced on the neck by the ligature. (Op. cit., t. 2, p. 408.) If a few hours were suffered to elapse, so that the body had become cold before suspension, no ecchymosis was produced by the ligature. Vrolik found, however, that a slightly livid mark was produced on the neck of a dead body, which had been suspended after the lapse of *an hour* from the time of death. (Casper, 'Wochencshr.,' Feb. 1838.) Hence this condition of the mark in a body found dead merely indicates, either that the deceased must have been hanged while living, or very soon after death. It would be for a jury to decide between these two assumptions, and to consider why, when a man had really died from any other cause, his body should have been hanged in secrecy immediately after death. (See 'Ann. d'Hyg.,' 1842, t. 1, p. 134.) The circumstance that an ecchymosed mark may be produced by suspending a recently dead body bears out the statement of Merzdorff, that it would be in the highest degree difficult, if not utterly impossible, to determine medically, from an inspection, whether a man had been hanged while living, or whether he had been first suffocated and his body suspended immediately after death. In making this admission, it is proper to bear in mind that that which is difficult to a conscientious medical jurist in confining himself to the medical facts, is often easily decided by a jury from these as well as the general evidence afforded to them.

Sometimes, besides ecchymosis, there are abrasions of the skin in the course of the cord, and these are known to have been produced during life by the effusion of blood which accompanies them. Devergie never met with this appearance in the hanging of a dead body, even when the hanging took place immediately after death. The discovery of effused coagula in or about the spinal column would render it probable that the deceased must have been hanged while living. Such marks of violence are, however, rare in cases of hanging, and, when they are found, it might be assumed that the effusion and coagulation of blood had been caused by violence offered to the neck *immediately after death*; but this assumption may be met by the question already suggested—namely, why death by hanging should be simulated in the body of a person who is alleged to have died from another cause.

With regard to the other, or more common kind of mark in suicidal hanging, it can scarcely be said to furnish any evidence in relation to the question which we are here considering. The depression may be hard and brown, although it does not usually acquire this colour until some hours have elapsed after death; for it appears to depend simply upon a desiccation or drying of that portion of the skin which has been compressed by the ligature. Sometimes the upper and lower borders only of the depression present a faint line of redness or lividity; and it is worthy of remark that, when the ligature presents any knots or irregularities, those portions of skin which sustain the greatest compression are white, while those which are uncompressed are found more or less ecchymosed. It is in this manner that the form of a ligature is sometimes accurately brought out. It may be remarked of these depressions produced by the cord, that the characters which they present are the same, whether the hanging has taken place during life or soon after death—the appearances are similar in the two cases.

The experiments performed on dead bodies, by Casper and other observers, show that the ordinary or non-ecchymosed mark caused by hanging during life may be produced by a ligature applied to the neck of a subject *within two hours* or at a much longer period after death; consequently the presence of this mark on the neck is no criterion whether the hanging took place during life or after death. The changes in the skin beneath the mark are also destitute of any distinctive characters: there is a similar condensation of the cellular membrane whether the hanging has occurred in the living or dead. These changes are the simple result of mechanical compression.

Chevers has pointed out a sign of death from hanging which is undoubtedly of high value. Very commonly in hanging, the head is forced on one side by the cord that suspends the body; and the saliva trickles from one angle of the mouth, from which point it descends on the clothing in a perpendicular direction. This appearance is not produced when the body is suspended after death. (‘Med. Jurispr. for India, p. 397.’)

Summary of Medical Evidence.—From the foregoing considerations, we draw the conclusion that there is no special or distinctive sign, except the last mentioned, by which the hanging of a *living* person can be determined from an inspection of the dead body. All the external marks may be simulated in a *dead* body, and the internal appearances furnish no characteristic evidence whatever. Still, when the greater number of the signs enumerated are present, and there is no other satisfactory cause to account for death, we have strong reason to presume that the deceased has died from hanging. We must not, however, abandon medical evidence on these occasions, merely because plausible objections may be taken to isolated portions of it. Facts may show that, however valid such objections may be in the abstract, they are wholly inapplicable in the concrete, *i.e.* to the particular case under investigation. Perhaps the greatest medical difficulties occur in reference to cases of *suicide,* owing to the slight appearances which attend this form of death; but on these occasions, moral and circumstantial proofs are so generally forthcoming that a medical inspection of the body is scarcely ever deemed necessary by a coroner. If, then, it is admitted by a medical jurist that it is not in all cases possible to distinguish hanging in the living from hanging in the dead, the admission must be considered as having reference to cases wherein persons destroy themselves, and not to cases in which they are destroyed by others. Even if a doubt were raised in any particular instance, it is more than probable that circumstantial evidence would furnish data for a decision, and thus satisfactorily make up for the want of strict medico-legal proofs. If when we found a deeply ecchymosed or livid mark around the neck of a dead subject, we said, all other circumstances being equal, that the person had most probably died by hanging, we should not be departing from a proper discharge of our duty; since, although it is medically possible that such a mark may, by a certain amount of skill, be produced after death, yet, as it would be only a murderer who would think of hanging up a recently dead body to simulate suicide, so it is certain that in this case there would be some obvious indications of another kind of violent death about the person. The absence of these, and the presence of ecchymosis in the course of the cord, would leave the question of hanging during life decidedly settled in the affirmative. Some caution should be used in expressing an opinion that hanging had taken place after death, even in cases in which there is no ecchymosis in the seat of the ligature; because, while such an opinion would be generally correct, it might in some instances lead to the concealment of the real mode of death. Many facts already adduced show that numerous cases of hanging during life would be pronounced to be cases of hanging after death, if the mere absence of ecchymosis in the mark were taken as a criterion. The discovery of marks of violence about the person is not of itself sufficient to rebut the presumption of death from hanging on these occasions. The violence should at least be of such a nature as to account for the immediate destruction of life, or it can throw no light upon the question whether the person might not have died from hanging, in spite of the marks of maltreatment found upon the dead body.

If, in reference to a body found hanging, a medical jurist should assert that death had *not* taken place from this cause, this would be tantamount to declaring that the deceased must have been murdered, because it is difficult to suppose that any one but a murderer would have a reasonable motive for hanging up a recently dead person. This hanging after death has been frequently carried out with the view of concealing the real mode of death, and of making the act appear to be one of suicide.

Marks of Violence on the Hanged.—The presence of marks of violence on the body of a hanged person is important, and therefore a witness should notice accurately their number, situation, extent, and direction. Having satisfied himself that they must have been received during life, he will have to consider the probability of their being of accidental origin or not. These marks of violence are not always to be regarded as furnishing unequivocal proofs of murder; for it is possible that they may have been produced by the person himself before hanging, and, not succeeding in committing suicide by these attempts, he may subsequently have resolved to accomplish his purpose by suspending himself. Let the witness duly reflect on these circumstances before he allows his opinion to implicate any suspected individual—let him consider that a hanged subject may bear the marks of a gunshot-wound, his throat may be cut, his person lacerated or disfigured, and yet, before a suspicion of homicide is allowed to be entertained, it ought to be clearly shown that such injuries could not, by any probability, have been self-inflicted. The importance of observing caution in such a case will be still more manifest when there is no ecchymosis produced by the cord, and the face does not present the usual appearances of hanging. (See 'Ann. d'Hyg.,' 1870, t. 2, p. 226.)

Marks of violence on a hanged subject may in some instances be fairly ascribed to *accident*. If the person had precipitated himself with any violence from a chair or table in a furnished apartment, he may have fallen against articles of furniture, and thus have caused lacerations and bruises, especially on the limbs or body. The rope may have given way, and the person, in falling, have injured himself; but he may afterwards have had resolution enough to suspend himself again. Such an occurrence may be rare; but when the presence of these injuries is made to form the chief ground of accusation against another person, their possibly accidental origin ought not to be lost sight of by a considerate witness.

The falling of the body on a hard pavement, or against some article of furniture, may produce accidental injuries which might be wrongly assigned to homicidal violence. In a case of suicidal hanging in the gaol of Newgate, there was a copious effusion of blood from injuries produced accidentally after death. In death from asphyxia the blood remains fluid in the body longer than in other cases, so that accidental wounds after death may be attended with comparatively large effusions. The bleeding *post mortem* is also favoured by the general congestion of the venous system. ('Ann. d'Hyg.,' 1868, t. 2, p. 218.) Severe injuries may be found on the head of the deceased, and yet these may not be inconsistent with suicidal hanging. ('Ann. d'Hyg.,' 1867, t. 1, p. 164; also t. 1, p. 460.)

If we suppose the deceased to have been hanged in a state of intoxication or stupefaction, medical evidence alone will rarely suffice to determine the question of homicide or suicide. The absence of all marks of violence from the body might actually lull suspicion. It is proper on these occasions to look to the hands of the deceased, since it is with these that a person defends himself; and, unless taken unawares, it is almost certain, if the hanging were homicidal, that there would be traces of violence on these parts. The clothes would be torn and decomposed, and the whole appearance of the deceased would be that of one who had done his utmost to resist a violent murderous attack. There might be some injuries which could not be attributed to accident under the circumstances. Among these we may enumerate fractures, dislocations, deeply penetrating incised and gunshot-wounds. Now the question is—Do these serious injuries necessarily establish homicidal hanging? The answer must be in the negative: although when fractures or dislocations exist, there are strong grounds for suspicion. ('Ann. d'Hyg.,' 1842, t. 1, p. 160.)

Suicides frequently make attempts on their lives by various means, as by poison, the use of razors, knives, or pistols, and still retain power to hang themselves. Such cases as these are generally determined by circumstantial evidence. A suicide may attempt to destroy himself with a knife or pistol; he may fail in the attempt, and ultimately hang himself. Any description of wound, provided it be such as to allow of a person surviving a sufficient time, may thus be found on a hanged subject, and yet constitute no proof whatever of murder. If there are circumstances about the wound or injury which show that it could not have been self-inflicted, this, of course, will affect the conclusion; but when such circumstances are not met with, a cautious medical jurist should say, in answer to inquiries respecting the origin of these wounds, that they may have been inflicted either by the deceased himself or by another. The medical facts of the case might be consistent with either view. In one instance of suicidal hanging there were lacerated wounds upon the head, and a handkerchief was found blocking up the mouth. A woman committed suicide, in 1868, under the following circumstances. She fastened a cord to the top of a bed-post, put her head in a noose while kneeling on the bed, and then made a deep wound in her arm with a razor; she closed the razor and put it aside. Becoming faint from loss of blood, she must have fallen forward, and the pressure of the cord on the neck caused death. Of course, if, in any case, the wounds or injuries are of a decidedly mortal nature, and have probably caused death, the presumption of murder is very strong; for who but a murderer would suspend the dead body of a person so wounded *immediately* after death? ('Ann. d'Hyg.,' 1835, t. 2, p. 410.)

Was the Hanging the result of Accident, Homicide, or Suicide?—Most medical jurists have passed over the subject of *accidental hanging*. In the sense commonly implied by the term, it is certainly unusual; but, although rare, it is a possible occurrence. Circumstantial evidence will always suffice for the discrimination of accidental hanging; and we have therefore merely to inquire whether, when the body of a person is found hanging under circumstances which do not allow of the suspicion of accident, the act has been the result of *suicide* or of *homicide*. A medical witness must remember that this is strictly a question for the jury. It is not for him to say whether a man has hanged himself or been hanged by others, but merely to state, when required, those *medical circumstances* which support or rebut one or the other presumption. The jury, under the direction of the judges will arrive at a conclusion from the whole of the evidence, medical and non-medical.

Hanging is a very common form of suicide; and of the persons thus destroyed, four-fifths are males. It has been truly observed that, of all the forms of committing murder, hanging is one of the most difficult, and it is a kind of murder seldom employed. In most cases when a person has been hanged by others, it has been after death, in order to avert a suspicion of homicide. Hence the discovery of a person hanging affords *primâ facie* evidence of suicide, supposing it to be rendered absolutely certain that death has taken place from this cause. We must, however, admit that a man may be murdered by hanging, and that the appearances about his body will not afford the smallest evidence of the fact. The circumstances which will justify a medical jurist in making this admission are the following:—First, when the person hanged is feeble, and the assailant a strong, healthy man. Thus a child, a youth, a woman, or a person at any period of life worn out and exhausted by disease or infirmity, may be destroyed by hanging. Second, when the person hanged, although usually strong and vigorous, is at the time in a state of intoxication, stupefied by narcotics, or exhausted by his attempts to defend himself. Third, in all cases, murder may be committed by hanging, when many are combined against one person. With these exceptions, a practitioner will be correct in deciding, in a suspected case, in favour of the presumption of suicide. Unless the person laboured under stupefaction, intoxication, or great bodily weakness, we must expect to find, in homicidal hanging, marks of violence about the body; for there are few who would allow themselves to be murdered without offering some resistance.

Some medical jurists have thought that the *mark* left by the cord on the neck would serve as a criterion of murder on which we might depend. Thus it has been said, if the mark is circular and situated at the lower part of the neck, it is an unequivocal proof of murder. In suicidal hanging, the mark of the cord is generally oblique, being higher at the back part of the neck, in consequence of the loop formed by it yielding more in this direction than in front. But it is an error to suppose that this want of obliquity in the impression can afford any evidence in favour of the act having been homicidal. Its form will depend in a great degree upon the fact of the body being supported or not, for it is the weight of the body which causes its obliquity; it will also depend on the manner in which the cord is adjusted. A case of suicidal hanging is related by Orfila, in which the mark of the cord extended horizontally round the neck from behind forwards. ('Méd. Lég.,' tom. 2, p. 376.) The slip-knot of the cord was in front of the neck, and it is obvious that, when the cord is thus adjusted by a suicide, there will be scarcely any obliquity in the depression produced by it. Equally ill founded is the assertion that the existence of *two impressions* on the neck affords positive proof of homicide. One of these impressions may be at the lower part of the neck, and circular—the other at the upper part, and oblique: it is, therefore, contended that the deceased must have been strangled in the first instance and afterwards hanged. The possibility of a prior attempt being made by a suicide to strangle himself, and thus produce the mark, is not adverted to. 'Si l'on observe les deux impressions,' says Mahon, 'l'assassinat est alors parfaitement prouvé.' It is fortunate that there are facts on record to oppose to this very positive statement. One of the first cases reported by Esquirol is that of a female lunatic who committed suicide by hanging herself, and on whose neck two distinct impressions were seen—the one circular, the other oblique. These appear to have arisen from the cord having been passed twice round the neck, the body being at the same time partially supported.

In some instances a presumption of homicidal interference may exist if there are two distinct impressions, but it cannot be admitted that they establish the fact of murder. A woman was found hanging to the branch of a tree, the feet resting on the ground. There were two marks on the neck, one like that of strangling with the same ligature as that by which the body was hanging. Walter concluded that the mark produced by the suspension of the body was the result of post-mortem hanging after murder by strangulation. ('Vierteljahrsschr. für Gerichtl. Med.,' 1867, 1, p. 161.) In the same journal (1871, 2, p. 223), a case is reported by Maschka in which a boy, æt. 9, was found hanging. There were on the neck marks of pressure, which at first led the examiners to draw the inference that the boy had been strangled, and afterwards hanged. The reasons for this opinion were not satisfactory, and suicide was admitted to be not only possible, but probable.

The injury done to the neck by the cord or ligature can rarely afford any clue to the manner in which hanging took place, unless the circumstances under which the body is found favour the presumption of homicide or suicide. Thus laceration of the muscles and vessels of the neck, rupture of the windpipe and displacement of the larynx, stretching of the ligaments of the spine, and effusion of blood on the sheath of the spinal marrow, may be observed in suicidal as in homicidal hanging. The presumption, however, is obviously in favour of the latter, when these violent injuries are found to be accompanied by fracture or displacement of the vertebræ of the neck, and the body of the deceased is not corpulent, the ligature by which he is suspended is not of a nature to produce them, and the fall of the body has not been great.

A much-disputed question has arisen in medical jurisprudence, whether the vertebræ of the neck can become fractured or displaced in *suicidal* hanging. Most medical jurists deny the possibility of this accident occurring—the displacement or fracture of these vertebræ being rarely observed, even in criminal executions when the greatest violence has been used by the executioner. The author found no case of *suicide* on record in which such an injury to the neck had been found. Still, it must be admitted to be possible.

Circumstantial Evidence.—In all doubtful instances we should not lose sight of moral and circumstantial evidence. We should ascertain whether the individual had been previously disposed to commit suicide or not: we should observe whether the doors and windows of the apartments had been secured on the inside or on the outside; whether the dress of the deceased is at all torn or discomposed, or his hair dishevelled; whether the attitude of the body is such as to show interference after death; whether there are marks of blood about the body, or the ligature, or in the room; whether the hands are bloody, or present marks of wounding or struggling; whether the rope or ligature corresponds to the impression seen around the neck; and lastly, whether the cord is of sufficient strength to support the weight of the deceased. The strongest evidence of homicide is often found in the attitude and the state of the dress of the dead body: it may or may not indicate interference or change after death, irreconcilable with the supposition of death from suicide or accident. On this point the minutest circumstance may become of considerable importance as medical evidence. When there are indications of violent struggling, the dress may be found disordered, unless it has been smoothed or arranged by the murderer after the death of the deceased. There may, of course, be no evidence of disorder or discomposure of the dress in the case of a female, when the body is freely suspended. These points fall, it is true, more within the province of the officers of justice than of a medical practitioner; but the latter is generally the first who is called to see the deceased, and therefore, unless such facts are noticed by him on his visit, they may remain altogether unknown. The medical opinion of the actual cause of death, however, should be based only on *medical* facts, but circumstantial evidence has on various occasions assisted in clearing up a doubtful case. Louis states that, on removing the body of a man who was found hanging, the rope was observed to be stained with blood. This simple circumstance led to further investigation, by which it was discovered that the person had been murdered, and his body afterwards suspended. The presence of marks on the neck indicative of strangulation, such as the cord was not likely to have produced, may lead to a suspicion that the hanging followed death.

The Position of the Body.—Lastly, it has been contended that the *position* of the dead body may serve to distinguish suicidal from homicidal hanging. This point was strenuously argued on the investigation which took place relative to the death of the *Prince de Condé,* in 1830. This case involves two glaring errors in reference to medical evidence in death from hanging: first, that a person cannot die from hanging when the body is in any way supported; second, that in all cases of death from hanging, the mark produced on the neck by the cord or ligature must be discoloured or ecchymosed. If not ecchymosed, it was assumed that death must have taken place from some other cause, and the body have been afterwards suspended for the concealment of crime. It is scarcely necessary to state that these propositions are utterly inconsistent with well-known facts. Since this trial, many cases have been recorded in which death has taken place from hanging, when the feet were in contact with the ground, or the persons were almost sitting or recumbent: they may be regarded as mixed cases of hanging and strangulation. The following case fell within the author's own knowledge. In 1832, a man was found hanging in his room, with his knees bent forwards, and his feet resting upon the floor. He had evidently been dead for some time, since cadaveric rigidity had already commenced. The manner in which this person (a working mechanic) had committed suicide was as follows: he had made a slip-knot with one end of his apron, and, having placed his neck in this, he threw the other end of the apron over the top of the door, and shutting the door behind him he had succeeded in wedging it in firmly. At the same moment he had probably raised himself on tiptoe, and then allowed himself to fall; in this position he died. The weight of his body had already sufficed to drag down a part of the apron, for it seemed as if it had been much stretched. The deceased was in the position in which the body of the Prince de Condé was found, and the depression produced by the ligature on the neck was, as in that case, nowhere ecchymosed. These facts, so far from being considered to negative suicide, were treated as perfectly in accordance with it. A similar case of suicide occurred in 1872. A lady, who had been for some time suffering from great depression, was found dead, hanging by a long cloth to a closed door, over the top of which she had thrown the other end of the cloth (knotted), and then shut the door upon it. (For a similar case, see Henke's 'Zeitschrift,' 1843, 2, 50.) Casper reports an instance in which a man was charged with the murder of his wife because her body was found hanging in almost an erect position! ('Ger. Leich.-Oeffn.,' vol. 2, p. 92.) (For other cases, with illustrations of the positions of the body, see a paper by Tardieu, 'Ann. d'Hyg.,' 1870, t. 1, p. 94.)

In a case of suicide at Oxford, in 1876, the body of deceased was found hanging behind the door of his bedroom. His feet touched the ground and his knees were bent. A woman, æt. 62, confined in Clerkenwell prison in April, 1878, was soon afterwards found dead in her cell. The body was resting on the ground, suspended from a gas-pipe about four feet high, by a neckerchief round her throat. In 1877, Spenser, a barrister, was found dead in his bedroom under the following circumstances: he was in a sitting position on the floor, with the bell-pull, attached to the bed-post, tied round his neck. There was no doubt that this was an act of suicide. In another case of suicide, the subject of an inquest in 1878, a man was found dead suspended by a handkerchief to a cupboard door. When standing upright he was as high as the cupboard door, but, after suspending himself, he had drawn up his legs behind him, and had died asphyxiated in this singular position. In 1874, a lunatic who had escaped from his keepers was found hanging in a wood near Highgate to a sapling oak by a pocket-handkerchief. The deceased was in a sitting posture, the tree being bent down by his weight.

The reports of eleven cases of suicidal hanging or strangulation gave the following results: in three, the deceased were found nearly recumbent; in four, in a kneeling posture, the body being more or less supported by the legs; and in four, the persons were found sitting. In one case the deceased, a prisoner, was found hanging to the iron bar of the window of his prison, which was so low that he was almost in a sitting posture. Remer found that among one hundred and one cases of suicidal hanging, in fourteen the body was either standing or kneeling, and in one instance it was in a sitting posture. Duchesne has published an account of fifty-eight cases in which the suspension of the body was partial—the feet or trunk being more or less supported. The reporter drew the conclusion that *suicide* by hanging is consistent with *any posture* of the body, even when resting upon the two feet. ('Ann. d'Hyg.,' 1845, t. 2, pp. 141 and 346.) Further evidence need not be adduced to show how unfounded is that popular opinion which would attach the idea of homicidal interference to cases in which a body is loosely suspended, or in which the feet are in contact with any support. We ought rather to consider these facts as removing a suspicion of homicide; for there are probably few murderers who would suspend their victims, either living or dead, without taking care that the suspension was not partial, but complete. Besides, the facts of many of these cases are readily explicable: thus, if the ligature is formed of yielding materials, or if it is only loosely attached, it will yield to the weight of the body after death, and allow the feet to touch the floor, which they might not have done in the first instance. If there is reason to believe that the body has not altered its position after suspension, we must remember the suddenness with which insensibility comes on, and the rapidity with which death takes place in this form of asphyxia. Under very slight pressure on the windpipe a person is rendered utterly powerless to help himself or to move from his position. (See p. 426, *post*; also 'Lond. Med. Gaz.,' vol. xliv. p. 85.) In spite of these well-known facts, the most serious mistakes are still liable to be made. A case occurred in France, in 1872, in which a young man was charged with the murder of his brother, and suspending his body after death. The only grounds for this strong medical opinion were that there was no deep ecchymosed depression round the neck of the deceased, and the body was found hanging nearly in a sitting posture. These conditions were considered to be inconsistent with death from hanging. The cause of death was ascribed to poisoning with phosphorus, in consequence of some alkaline phosphates and phosphoric acid being found in the stomach. On this series of medical assumptions and mistakes, the young man, who had accidentally discovered his brother hanging, was convicted of murder, and sentenced to the galleys for twenty years. The ignorance displayed by the medical witnesses who gave evidence on this occasion has been fully exposed by Boys de Loury, Chevallier, and Personne. (See 'Ann. d'Hyg.,' 1873, t. 2, p. 113.)

The Limbs secured in Suicidal Hanging.—One or two points are worthy of notice in relation to this medico-legal question. The hands or legs, but more commonly the former, have been found tied in cases of undoubted suicidal hanging ('Ann. d'Hyg.,' 1832, t. 1, p. 419); and yet it has been gravely debated whether it was possible for a person to tie or bind up his hands, and afterwards hang himself. It is unnecessary to examine the ingenious arguments which have been urged against the possibility of an act of this kind being performed, since they are refuted by well-ascertained facts. ('Lond. Med. Gaz.,' vol. xlv. p. 388; and 'Guy's Hosp. Rep.,' 1851, p. 206.).

It has also been a debated question whether *corporeal infirmity*, or some peculiarity affecting the hands, might not interfere with the power of an individual to suspend himself. This question can be decided only by reference to the special circumstances of the case. In the case of the *Prince de Condé*, it was alleged that he could not have hanged himself, in consequence of a defect in the power of one hand; it was also said that he could not have made the knots in the handkerchiefs by which he was suspended. Allegations of this kind appear to have been too hastily made in this and other instances. A determined purpose will often make up for a great degree of corporeal infirmity; and unless we make full allowance for this in suicide, we shall always be exposed to error in drawing our conclusions. Blindness is no obstacle to this mode of perpetrating suicide; and in reference to *age*, suicide by hanging has been perpetrated by a boy of nine, and by a man of ninety-seven years of age.

STRANGULATION.

CHAPTER 40.

CAUSE OF DEATH.—APPEARANCES AFTER DEATH.—WAS DEATH CAUSED BY STRANGULATION, OR WAS THE CONSTRICTION APPLIED TO THE NECK AFTER DEATH?—MARKS OF VIOLENCE.—ACCIDENTAL, HOMICIDAL, AND SUICIDAL STRANGULATION.

Cause of Death. Asphyxia.—Hanging and strangulation are usually treated together, and some medical jurists have admitted no distinction in the meaning of these terms. In hanging, the phenomena of asphyxia take place in consequence of the *suspension* of the body; while in strangulation, asphyxia may be induced, not only by the *constriction* produced by a ligature round the neck independently of suspension, but by the simple application of *pressure*, through the fingers or otherwise, on the windpipe. Tardieu considers that the two modes of death should be kept distinct. The external and internal appearances in some respects differ; and while the proof of death from hanging leads to the strongest presumption of suicide, the proof of death from strangulation is equally presumptive of murder. ('Sur la Pendaison et Strangulation,' p. 151.) This medical jurist defined 'strangulation to be an act of violence, in which constriction is applied directly to the neck, either around it or in the fore part, so as to prevent the passage of air, and thereby suddenly suspending respiration and life.' This definition obviously includes hanging, and every person who is hanged may be said to be strangled; but while there is only one method of producing death by hanging, there are various methods of producing death from strangulation. A person may be strangled by the use of a cord, band, or ligature drawn tightly round the neck, or by manual violence to the front of the neck, whereby respiration is prevented. The *cause* of death is asphyxia. The rapidity with which it takes place will depend on the degree and situation of the pressure, and the completeness with which the act of breathing is obstructed.

Faure applied a ligature forcibly and suddenly to the neck of a middle-sized dog. For fifty-five seconds the animal did not appear to suffer; but suddenly became violently agitated, its body stiffened, and it rolled convulsively on the ground. A bloody froth issued from the nostrils and throat, and the animal made frequent and violent efforts to breathe. In three minutes and a half it was dead. In a second experiment, an elastic tube was introduced into the windpipe, which admitted of being gradually closed by pressure. The animal could bear the pressure up to the reduction of one-half of the calibre of the tube; but beyond this it suffered greatly, and when the pressure was increased convulsions supervened. The dog died, in great suffering, before the tube was completely closed. ('Ann. d'Hyg.,' 1859, t. 1, p. 122.) It is probable that human beings die more quickly than animals, especially from the effects of manual strangulation. A sudden and violent compression of the windpipe renders a person powerless to call for assistance and give alarm, and it causes almost immediate insensibility and death without convulsions. When a ligature or bandage is used, the pressure is not so complete, and death takes place more slowly with convulsive movements. The circulation of dark-coloured blood continues for a short interval (about four minutes), as in other cases of asphyxia. Owing to this, the face and lips, in accidental strangulation, have been observed to acquire a dark-leaden hue. This arises partly from the arrest of the current of venous blood as the result of compression of the vessels, and partly from the circulation of unaërated blood. There is a fair chance of recovery if the cause of constriction is removed, and air is permitted to have access to the lungs, within a period of five minutes; this is on the assumption that no great mechanical injury has been done to the neck. In the act of strangulation a much greater degree of violence is commonly employed than is necessary to cause death; and hence the marks produced on the neck will be, generally speaking, much more evident than in hanging, where the mere weight of the body is the medium by which the windpipe is compressed.

Post-mortem Appearances.—The appearances after death are similar to those of hanging, but the injury done to the parts about the neck is commonly greater. Externally, if much force has been used in producing the constriction, the windpipe, with the muscles and vessels in the fore part of the neck, may be found cut or lacerated, and the vertebræ of the neck may be fractured. The face is commonly livid and swollen, the eyes wide open, prominent, and congested, and the pupils dilated. The tongue is swollen, dark-coloured, and protruded; it is sometimes bitten by the teeth, and a bloody froth escapes from the mouth and nostrils. The principal external signs of strangulation are seen in the marks on the neck, produced either by a cord or manual pressure. Tardieu has described another appearance which might be overlooked. This consists in the presence of numerous small spots of ecchymosis upon the skin of the face, neck, and chest, as well as in the conjunctiva or membrane of the eyes. These parts present a dotted redness, which has, however, been met with in other cases besides death from strangulation. ('Ann. d'Hyg.,' 1859, t. 1, p. 125.)

The mark on the neck when a ligature has been used is commonly described as a depression, wide, but not deep, and corresponding in its characters to the form and thickness of the ligature and the mode in which it has been secured. Too much importance must not be attached to this supposed correspondence when the ligature is not forthcoming. In a case of accidental strangulation which the author saw in 1864, the mark round the neck presented the appearance which might be expected from the use of a narrow cord. But in this instance a soft silk neckerchief was the means of constriction, and the peculiar narrowness of the mark on one side was owing to the great tightness with which it had been drawn. The mark or impression produced by a ligature is generally circular, from the mode in which the pressure is produced. It may be situated at any part of the neck, but it is more commonly below the windpipe. In manual strangulation, the marks of bruising and ecchymosis will generally be in the front of the neck, chiefly about the larynx and below it. In a recent case of homicidal strangulation (*Reg.* v. *Shaw*, Liverpool Ass., Nov. 1884), the following were the appearances noted, the strangulation of a woman having been effected by means of the fingers and thumb applied to the sides of the neck. There was a bruise, with extravasation of blood, immediately beneath the lobule of the left ear; and another, also with extravasation three quarters of an inch below the lobule of the right ear. Corresponding to this latter bruise, a second effusion of blood had taken place into the deeper tissues half an inch beneath the surface. There were other bruises over each eyebrow, at the back of the right wrist, over the knuckle of the left little finger, at the inner side of the left elbow, and at each angle of the mouth. Within the mouth was a contused and lacerated wound opposite the jagged stump of the canine tooth, and, exactly opposite to this, on the upper lip was a smaller bruise, with extravasation of blood. The tongue was bruised on the right side, as though it had been caught between the teeth. The left lateral upper incisor was loosened, and the tongue and effused blood showed that the wound was recent. The blood generally was dark and fluid. The brain and its membranes were intensely congested. There were no marks of injury to the throat. The lungs were congested, and emphysematous on the surface. The heart contained a quantity of dark fluid blood. The abdominal viscera were not noticeably congested. Urine and fæces had escaped. ('Med. Chron.,' i. p. 577.) The circular direction of a mark produced by the ligature is not an absolute indication that strangulation has taken place without suspension of the body, since cases of hanging have occurred in which a circular mark has been observed; and it is possible that some degree of obliquity may occasionally exist in the course of the depression produced by a ligature in strangulation. A medical jurist ought, therefore, to weigh all the facts connected with the position of the body and the nature and direction of the ligature, before he forms an opinion from the appearances presented by the mark on the neck, whether the person has been hanged or not. Greater importance is to be attached to the lividity, ecchymosis, and abrasion of the skin in the course of the ligature, than to the circularity or obliquity of the depression produced by it. In the strangling of a living person by a cord, it is scarcely possible that a murderer can avoid producing on the neck marks of severe injury, and, in the existence of these, we have evidence of the violent manner in which death has taken place.

In cases in which great violence has been used to the neck, blood may escape from the mouth and nose. It is a matter of popular belief that, if there is no open wound in the body, there can be no bleeding. In *Reg.* v. *Millar* (C. C. C., July, 1870), the prisoner was charged with the murder of a Mr. Huelin. One of the circumstances which led to the discovery of the crime was the large amount of blood which had escaped from the mouth and nose as a result of the act of strangulation. The evidence left it clear that the prisoner had murdered Huelin and his housekeeper, and had endeavoured to conceal the dead bodies. He had packed the body of the housekeeper in a box, and requested a carrier to place a cord round it. The man observed that fluid blood was oozing from the box, and that there was a large stain of blood on the floor beneath. On opening the box, the body of the woman was found inside. There was a cord tied tightly round the neck of the deceased, and blood had escaped from the mouth and nose and had run down the side of the box. The deceased had been strangled, and such an amount of force used in the tightening of the cord round the neck, as to lead to a copious effusion of blood from the mouth and nose. In cases of asphyxia, the blood, owing to its liquidity, continues to flow for some time after death from any lacerated wound or blood-vessel.

On the other hand, a person may be strangled, and yet the ligature, in consequence of its being soft and yielding, will not cause a perceptible depression or ecchymosis—scarcely anything more than a slight depression of the skin. If we except cases of suicide, such a condition must be rare, because assailants usually produce a much more violent constriction of the neck than is necessary to ensure the death of a person. The general lividity of the body, contraction of the fingers, with clenching of the hands and swelling and protrusion of the tongue, are more marked in strangulation than in hanging. A thin mucous froth tinged with blood is occasionally found in the air-passages in both cases. In some instances of violent strangulation, blood has escaped from one or both ears during the act; but this is not a usual appearance. In two well-marked cases in which the author was consulted, the constriction of the neck was carried to a great degree, but there was no bleeding from the ears. Geoghegan examined a case of *suicidal* strangulation in which the constriction had been produced by a ribbon, and the violence applied was sufficient to produce bleeding from one ear; on dissection, this was found to have resulted from a rupture of the membrane of the drum of the ear. There was no froth at the mouth or nostrils, and scarcely any lividity or swelling of the face. It was further observed that the mark on the neck, which was deep, almost disappeared after the removal of the ligature. Wilde met with a case in which rupture of the membrane of the drum of the ear, with effusion of blood, was caused by strangulation. Bleeding from the ears, as a result of rupture of the membrane of the drum, must, however, be regarded as an exceptional appearance. Chevers does not mention it as having been noticed in any one of the numerous cases which he has collected in his Indian experience, although bleeding from the nostrils had been observed. ('Med. Jurispr. for India,' 1856, p. 374.) Without rupture of the membrane of the drum, blood could not issue from the ears, and in order that this membrane should be ruptured, certain conditions not commonly met with are required.

The body of a woman who had been homicidally strangled, presented the following appearances: the skin of the head, face, neck, and chest was darker than natural, and discoloured underneath, particularly that of the scalp. The brain was suffused with dark blood, the lungs gorged and of a dark colour, the bowels of a dusky-red colour. The eyes were somewhat protruded and bloodshot, the lips swollen and darker than natural, the tongue slightly protruding between the teeth, and froth issuing from the nostrils. There was a mark of pressure behind the right ear, and other marks on the neck and chest, with discoloration of the muscles. (Chevers's 'Med. Jurispr. for India,' pp. 378, 387.) In a case of suicidal strangulation which occurred at Liverpool in 1863, the body of the deceased was found dead, cold, and rigid, about seven hours after he had been seen alive. The arms were flexed, and the hands raised a little above the breast. Round the neck, just below the cricoid cartilage, was a strip of the deceased's shirt, which had been used as a ligature: it was tied at the *back* of the neck. There was slight ecchymosis in the mark beneath. The skin of the face had a dark-red colour, and was dotted with spots of a deeper red. The conjunctivæ were ecchymosed, and some blood had escaped from the nose. The brain was congested, and much fluid effused. The heart was empty; the lungs were deep in colour (congested). ('Lancet,' 1863, ii. p. 183. See also *Reg.* v. *Shaw*, p. 427, *ante.*) Many of the cases of strangulation which have presented themselves have been too superficially examined. The most complete account of the appearances is that given by Tardieu. It is based on observations made in twenty-eight inspections. ('Sur la Pendaison et Strangulation,' p. 164.) The lining membrane of the larynx and windpipe was more or less reddened from congestion; sometimes it was livid or of a dark-red colour. There was a bloody froth extending into the air-tubes. The state of the *lungs* was variable.

Contrary to what is generally alleged to be characteristic of death by asphyxia, Tardieu found these organs to contain but little blood. Sometimes they were congested, at other times normal. There were ruptures of the superficial air-cells producing patches of emphysema, which were seen singly or in groups. This condition, which was rarely absent, gave to the surface of the lungs the appearance of being covered with white layers of thin false membrane. When these patches were punctured, air escaped. There was an absence of that condition of the lungs which he observed in death from simple suffocation, namely, dotted ecchymosis on the surface, immediately below the investing membrane (the pleura). Throughout the substance of the lungs, effusions of blood varying in size were, however, generally found, provided an early inspection of the body was made. When some days had elapsed, the lungs were found pale or congested, without any ecchymosed or mottled appearance. The ruptured air-cells, with air beneath them, were still visible on the surface.

The *heart* presents no uniform condition; being sometimes quite empty, and at others containing dark fluid blood. The *brain* is occasionally congested, but more commonly has its natural appearance. In one instance, blood was found effused on the brain, but this is unusual. It has also been stated that a congested state of the sexual organs, both in males and females, was one of the appearances connected with strangulation; but this has not been confirmed by careful observers. Tardieu met with nothing to call for notice in this respect in the numerous cases which he examined. The involuntary discharge of fæces, urine, and seminal or prostatic fluid, described as one of the characters of death by hanging, may occur in death from strangulation. No importance can be attached to this as a sign of death from asphyxia in any form. It frequently occurs in sudden and violent death from any cause, and there are many instances of death from asphyxia in which it is not observed. Among the occasional appearances of violent strangulation may be mentioned injury to the windpipe and the muscles of the neck around it. One case in which the rings of the windpipe were split as a result of pressure, was communicated to the author by Inman. Several instances of laceration and rupture of the windpipe are quoted by Chevers. (Op. cit., pp. 381, 384.) In one instance, the ossified thyroid cartilage had been broken and forced inwards, causing suffocation. In *Reg.* v. *O'Brien* (Liverpool Wint. Ass., 1857), a case of alleged murder by strangulation, the cartilage of the windpipe was broken; and in the case of *Pinckard* (Northampton Lent Ass., 1852), the windpipe was broken longitudinally. In reference to fractures of the larynx, see Casper, 'Klin. Novellen,' 1863, p. 497. In suspected homicidal strangulation, it is always proper to examine the contents of the stomach for narcotic poison. In all cases, the cord or ligature, if forthcoming, should be carefully examined, in order to determine whether it bears upon it marks of blood, or whether hair or other substances are adhering to it. A portion of it should be reserved for the purposes of identity. In two instances of homicidal strangulation, the ligatures found round the dead bodies were proved to correspond with portions of the same material found in the possession of the persons who were charged with the murders. In removing the ligature from the neck, the precise mode in which it is tied or secured should be noticed, as this may be a fact of importance in reference to an allegation of suicide.

The medico-legal questions relative to strangulation are of the same nature as those which have been already considered in treating of hanging. Thus, in examining the body of a person suspected to have been strangled, we may be required to answer the following questions:—

Was death caused by strangulation, or *was the constricting force applied to the neck after death?*—Medical jurists have considered that the *internal* appearances throw no light upon this question. This opinion probably arose from the fact that inspections have not been made until some days after death, when the peculiar appearances of strangulation have been merged in those of putrefaction. The state of the lungs, however, may be considered as characteristic. It would be impossible, by the application of a ligature round the neck of a dead body, to produce rupture of the air-cells on the surface of the lungs, and effusions of blood in their substance. The state of the eyes and of the inside of the larynx and windpipe in persons who have been strangled could not be imitated by any constriction of the neck after death: no bloody mucous froth would be found in the windpipe or air-tubes. The *external* appearances have been considered to furnish more accurate means of distinction. Although the condition of the neck generally yields the strongest evidence, it will be proper to seek for that appearance of dotted redness or ecchymosis in the skin of the face, neck, and chest, described by Tardieu. The state of the eyes, as to their prominence and the congestion of the membranes, as well as the position of the tongue, should also be examined. The ecchymosis about the depression of the neck, when a ligature has been employed, with the accompanying swelling and lividity of the face, are phenomena not likely to be simulated in a dead body by the application of any degree of violence. When the constriction is produced within a few minutes after death, an ecchymosed depression may result; but it is improbable that there should be any lividity or swelling of the countenance. Casper found that, when the constricting force was not applied to the neck until *six hours* after death, a mark indicative of vital strangulation could *not* be produced. It is doubtful whether it could be produced in the dead body even an hour after death. The period cannot be determined with positive certainty; the results would probably vary, according to the rapidity with which the body had cooled.

This question was of importance in the case of *Marguerite Dixblanc*, tried (C. C. C., June, 1872) for the murder of her mistress, *Madame Riel*. The body of deceased was found with marks of violence about the head, sufficient to account for death, and there was a rope tightly drawn round the neck. In the defence it was suggested that the rope had been placed round the neck after death for the purpose of dragging the body to the place where it was found. Another theory was that the prisoner had strangled her mistress with the rope. From the appearance of the neck, the medical evidence left it doubtful whether the rope had been applied during life or soon after death. If the former, it would have proved a deliberate design to murder. The prisoner received the benefit of the doubt, and, although found guilty, the capital sentence was commuted.

It is difficult to conceive under what circumstances an attempt to simulate strangulation in a recently dead body could be made, unless for the purpose of throwing suspicion upon an innocent person connected with the deceased. When an individual has been murdered, it is not likely that the murderer would attempt to produce the appearances of strangulation on a body after death, under the idea of concealing his crime; for strangulation is, in most cases, an actual result of homicide, and is rarely seen as an act of suicide. A rope might, however, be applied, as in Dixblanc's case (p. 431), for the purpose of dragging the body. In the absence of ecchymosis, from the neck, it will be difficult to form an opinion, unless from circumstantial evidence; but there may not be an ecchymosed *circle;* for a person may be strangled by the application of pressure to the windpipe through the medium of the finger-nails, or of any hard or resisting substance. The ecchymosis on the neck in such cases will be in detached *spots* or *patches.* In the absence of all marks of violence round the neck, we should be cautious in giving an opinion which may affect the life of an accused person; for it is not probable that homicidal strangulation could be accomplished without the production of some appearances of violence on the skin over the larynx or windpipe. It is doubtful whether strangulation can ever take place without some mark being found on the neck indicative of the means used. The bare possibility of death being caused in this manner, without leaving any appreciable trace of violence, must be admitted; although the admission scarcely applies to those cases which require medico-legal investigation. Suicides and murderers generally employ much more violence than is necessary for the purpose of destruction—hence detection is easy. But if a soft and elastic band were applied to the neck with a gradually regulated force, it is possible that a person might die strangled, without any external sign being discovered to indicate the manner of his death. Indian surgeons inform us that the Thugs, and other robbers met with in India, are thus accustomed to destroy their victims with the dexterity of practised murderers.

A case involving this question of strangulation without marks of violence on the neck, was tried in France, and from the medical evidence decided in the affirmative. ('Gaz. Méd.,' 1846, p. 375.) The medical witness should, however, be prepared to consider whether, in the absence of any mark, death might not have proceeded from another cause, and leave it to the authorities of the law to decide, from circumstances, in favour of or against the prisoner. There is nothing sufficient to justify a medical witness in stating that death has proceeded from strangulation, if there should be no appearance of lividity, ecchymosis, or other violence about the neck or face of the deceased. Congestion in the organs of generation is an appearance which it would not be safe to take as positive evidence of death from strangulation. The state of the countenance will not warrant the expression of an opinion unless it is accompanied by other well-marked signs of this mode of death; for there are many kinds of death in which the features may become livid and distorted from causes totally unconnected with the application of external violence to the throat. So, again, the eyes and tongue may be protruded as a result of putrefactive changes. Let not a witness, then, lend himself as an instrument for the condemnation of a person against whom nothing but a strong suspicion from circumstances may be raised, and where medical evidence is unable to furnish any distinct and conclusive proofs of death from strangulation. This caution is especially necessary in reference to the inspection of bodies which are in a state of putrefaction. A medical man, already provided with a theory of the cause of death by the discovery of a rope or other means of constriction found near a dead body, may easily arrive at the conclusion that death has taken place from strangulation. The absence of the usual confirmatory appearances in the body may be ascribed to decomposition, and those caused by decomposition may be set down to strangulation. Where there is obvious mechanical violence to the neck, such as fracture of the larynx or windpipe, with laceration of the muscles beneath, a visible depression, such as a cord, a ligature, or manual pressure would produce, a medical opinion may be fairly given in spite of putrefaction. But when, in a putrefied body, indistinct marks on the neck, or patches of discoloration are relied upon as evidence of homicide, there is great risk of a serious mistake.

In cases of alleged strangulation, a question may be put to a medical witness as to how far his opinion as to the cause of death has been influenced by the discovery of a rope or ligature around the neck of the deceased, or in the apartment in which a dead body is found. A medical opinion should rest upon the clear and obvious changes produced on the neck and on the structures below the skin, and not upon the mere presence of a cord or ligature. This might be put round the neck of a dead body, or near to it, for a malicious purpose. The act of strangulation should be, medically, as distinctly provable without the production of a rope, as the act of stabbing without the production of the knife which inflicted the stab. If these principles are not strictly adhered to in practice, policemen will be as competent as medical experts to give evidence of the cause of death in cases of alleged strangulation.

It is scarcely necessary to state that all marks of violence on the body of a supposed strangled person should be accurately noted, as the questions respecting them, however slight the marks may be, are material. The witness will be expected to state whether they were inflicted before or after death; if before, whether they were sufficient to account for death, or whether they were such as to be explicable on the supposition of an accidental, suicidal, or homicidal origin. It should be observed whether there exist any morbid changes sufficient to account for death, in either of the three great cavities of the body, as this kind of negative evidence may be essential in the progress of a case. In reference to females, whether children or adults, the surgeon should not neglect to examine the sexual organs, in order to ascertain whether there are any marks of violation. Cases have occurred in which rape has been perpetrated, and strangulation resorted to for the purpose of concealing the crime.

Strangulation, like hanging, is occasionally the result of *accident*, but the occurrence may be looked upon as rare. When the body is not suspended, it is commonly more in the power of a person to assist himself, and escape from the constriction; hence cases of accidental strangulation are less frequent than those of accidental hanging. As a general rule, cases in which the constriction of the neck has been produced by some accident present no difficulty to a medical jurist, provided the relations of the body to surrounding objects and the compressing force have not been disturbed. Should it happen, however, that the body has been removed from the place in which it was first discovered, or the ligature taken from the neck, we can only establish a presumption of accident from the description given.

When a charge of murder is instituted against a person, an attempt is not unfrequently made by counsel for the defence to show the probability that the deceased might have fallen while in a state of intoxication, and have become accidentally strangled, either by a tight cravat or by some foreign substance exerting pressure on the windpipe. If we admit the possibility of an occurrence of this nature, we must not lose sight of the existence of other more probable causes of death, nor should we allow our judgment to be so swayed as to abandon what is probable for that which is merely possible.

Suicidal Strangulation.—This mode of suicide is of rare occurrence, and, except under particular circumstances, impossible. The possibility of an individual strangling himself was for a long time denied by medical jurists; for it was presumed that, when the force was applied by the hand, all power would be lost as soon as the compression of the windpipe commenced. Physiologically correct, this reasoning is, however, only applicable to those cases in which the windpipe is voluntarily compressed by the fingers. When a person determined on suicide allows the windpipe to be compressed, by leaning with the whole weight of his body on a cord passed round his neck and attached to a fixed point, he may perish in this manner almost as readily as if he had hanged himself; for insensibility and death will soon supervene. In the chapter on Hanging, it was stated that suicides were often found with their bodies in close contact with the ground; and cases are reported in which strangulation was accomplished, in the manner above described, while the suicide was in a sitting or kneeling posture (p. 422). On other occasions, the peculiar disposition or nature of the ligature has enabled a person bent on suicide to strangle himself without much difficulty. An instance is related by Orfila, in which two cravats, that were twisted several times round the neck of the deceased, who was discovered lying on his bed, had effectually served the purpose of self-destruction. ('Méd. Lég.,' vol. 2, p. 389.) Sometimes strangulation has been suicidally effected by a rough cord passed repeatedly round the neck, and tightened by being pulled with each hand. The number of coils would still cause some pressure to be exerted even when the grasp was relaxed by death. ('Guy's Hosp. Rep.,' 1851, p. 371.) Other cases are related, in which suicides have succeeded in strangling themselves by tightening the ligature with a stick (ibid., p. 371); or, when the ligature was formed of thick and rough materials, by simply tying it in a knot. In the case of a youth found dead in a field with the handle of a pitchfork passed under the necktie, there were marks of strangulation on the larynx, the eyeballs protruded as well as the tongue, which was livid and marked by the teeth. The brain was full of fluid venous blood. There was no doubt that death had taken place by strangulation, probably suicidal, as it is difficult to conceive that the handle of the fork could have come by any accident into the position in which it was found. A case occurred in 1875, in which a man was found dead in bed, with his handkerchief tied round his neck and twisted from right to left by means of a razor-strop. There was no doubt that this was a case of suicidal strangulation.

Although suicidal strangulation may be effected under unexpected circumstances, yet in a case of murder by strangulation it would not be easy to simulate suicide: it would at any rate require great skill and premeditated contrivance on the part of a murderer so to dispose the body of his victim, or to place it in such a relation to surrounding objects, as to render a suspicion of suicide even probable. Thus, if the cord or ligature should be found loose or detached, if the ecchymosis or mark in the neck should not accurately correspond to the points of greatest pressure, if, moreover, the means of compression were not evident when the body was first discovered and before it had been removed from its situation, there would be fair grounds for presuming that the act was homicidal. In those cases in which strangulation has resulted from a compression of the windpipe by the fingers, and where there are fixed ecchymosed marks indicative of direct manual violence, we have the strongest presumptive evidence of murder; for neither accident nor suicide could be urged as affording a satisfactory explanation of their presence.

Hoffmann met with an instance of this kind in which he rightly concluded, from the deep depressions in the neck of the deceased, attended with abrasion of the cuticle and effusion of blood, as well as from the great injury done to the parts about the larynx and windpipe, that the strangulation was homicidal. ('Vierteljahrsschr. für Gerichtl. Med.,' 1873, 2, p. 89.) This case is remarkable for another fact. The assassin had wiped his hand, which must have been stained with blood from the violence used, on a towel which was found concealed, but was subsequently traced to his possession. It was affirmed, in defence, that the blood on the towel was of old date, but the spectroscope showed that it had the characters of recent blood. That this had been used for the purpose stated was proved by the discovery on it of the shreds of epidermis and the fine downy hairs of the deceased, such as would have been removed under violent pressure with the fingers.

Homicidal Strangulation.—Strangulation occasionally comes before our courts as a question of murder: and when a person has been tried upon a charge of this kind, the circumstances have been commonly so clear as to render the duty of a medical witness one of a simple nature. When the cause of death is contested, or when it is contended in defence that the strangulation is suicidal, a medical witness must be prepared to give his reasons for affirming that the act was one of strangulation, and not done by the deceased himself. He must be prepared to meet and explain the differences between the case under investigation and those reported cases which are admitted to have been suicidal. The attitude of the body, the condition of the dress, the means of strangulation, the presence of marks of violence or of blood on the person of the deceased, on his clothes or the furniture of the room, or on the rope or ligature, are circumstances from which, if observed at the time, important medical inferences may be drawn. As a rule, a criminal who attempts to imitate suicide under such a form of murder must, when the facts are properly investigated, inevitably fail in his object. The assassin either does too little, or he does too much. In one case of murder by strangulation, the woman who perpetrated the crime had been a nurse in an infirmary, and accustomed to lay out dead bodies. After the act of murder, she appears to have carried out, unthinkingly, her professional practice, by smoothing the clothes under the body, placing the legs at full length, the arms out, straight by the side, and the hands open and laid out. Such a condition of the body was quite inexplicable on the supposition of suicide, considering the amount of violence which must have attended the strangulation. In another case, the criminal had attempted to make the death appear like an act of suicide by placing the lower end of the rope near the hand of the deceased; but he selected the *left* hand, whereas the deceased was right-handed, and he did not leave enough rope free from the neck for either hand to grasp, in order to produce the very violent constriction of the neck which had been caused by the two inner coils. Both of these criminals confessed their crimes before execution.

Sometimes the appearance of the *mark* on the neck will allow us to establish a slight presumption for or against homicide. In homicidal strangulation, from the unnecessary violence used, we may expect to find the skin much ecchymosed, lacerated, or excoriated; and the deep-seated parts, such as the muscles and vessels, as well as the windpipe itself, more or less bruised, lacerated, or extensively injured. Such a degree of violence is not commonly found in cases of *suicidal* strangulation. Fracture of the hyoid bone, larynx, and windpipe generally indicate an amount of violence inconsistent with suicide. In *Reg.* v. *Woodford* (Lewes Spring Ass., 1876), a case of alleged murder by strangulation, the medical evidence showed not only the marks of a thumb and fingers, as if the deceased had been seized by the throat, but the hyoid bone was found fractured at a spot corresponding to a mark on the throat. There was no doubt that these were the results of homicidal violence, and the prisoner was convicted. The mark on the neck has sometimes furnished evidence of this mode of death, even under circumstances in which it might be supposed all evidence would be destroyed. Schüppel describes a case in which he was able to verify the fact of strangulation after the burning of the body. In 1869, a fire took place in a cottage in which there were at the time a man, his wife, a stepson (æt. 10), and a new-born infant. The man escaped with the infant, and said that his wife and stepson had left the house before the fire. This was proved to be a falsehood: their dead bodies were subsequently discovered much burnt. A suspicion of incendiarism and murder arose, and the remains were examined by Schüppel. On the burnt remains of the neck of the boy there was a horizontal mark or depression encircling the greater part of the neck, about a quarter of an inch wide, and presenting a smooth surface, quite distinct from the broken, blistered, and carbonized skin above and below it; and the tongue protruded from the mouth. From this condition of the neck and tongue, Schüppel drew the conclusion that the boy had died from strangulation, and that the ligature had been applied to the neck while the boy was living, and had been burnt with the body. ('Vierteljahrsschr. für Gerichtl. Med.,' 1870, 2, p. 140.) The man was found guilty of the murder of his wife and stepson, and a few days afterwards he committed suicide by hanging himself while in prison. He had set fire to the house after the murder, in order to conceal this double crime.

In *Reg.* v. *Lunnum* (Warwick Lent Ass., 1873), a woman was charged with the murder of her child, a month old, by strangulation. There were five quite recent marks on the throat, such as would be produced by the pressure of four fingers and a thumb. The prisoner stated that these marks were produced by her a fortnight previously, in trying to get a button out of the child's throat. They were too recent to admit of this explanation, and she was convicted of manslaughter. In the case of the *Countess of Goerlitz* (*ante*, p. 382), whose body was destroyed by burning, the tongue protruded from the mouth, thus indicating death by strangulation. In another case some of the appearances of strangulation were found in spite of the subsequent burning of the body.

It is proper to notice in this place the occurrence of what are called '*Garote robberies.*' The system of murder normally pursued by the Thugs in India appears to have been imported into England, and many lives have been destroyed by the employment of strangulation for the purposes of robbery. In spite of numerous convictions, there is reason to believe that some criminals still set the law at defiance. The rigorous proof required of facts which under these assaults can rarely admit of proof, confers impunity on the assailants. The attack is made during darkness; the person is seized by the windpipe from behind, or a bandage is thrown around his neck; and this is suddenly tightened, while accomplices are engaged in perpetrating robbery. The nature of the assault, by pressure on the windpipe, renders it impossible to give an alarm or call for assistance. The person assaulted, if he should recover, is seldom able to identify an assailant: he is attacked from behind, is rendered immediately unconscious and powerless, and can rarely offer resistance. Recovery or death in such cases depends on the lapse of a few seconds, more or less, during which the constriction of the neck is continued; on the degree of constriction; and on the age, sex, and strength of the constitution of the person assaulted. An attempt at strangulation, as in garoting, besides inflicting serious local injury to the windpipe and other parts near to it, may cause a state of insensibility which may continue for some hours. There is severe pain in the throat, with difficulty of speaking and swallowing, and if the larynx be seriously injured there may be loss of voice. Dumbness, however, is not one of the secondary symptoms, and loss of voice is usually only temporary during the pressure. By 24 & 25 Vict., c. 100, s. 14, it is enacted, *inter alia*, that 'whosoever shall attempt to drown, suffocate, or strangle any person, with intent to commit *murder*, shall, whether any bodily injury be effected or not, be guilty of felony; and being convicted thereof shall be liable, at the discretion of the court, to be kept in penal servitude for life, or for any term not less than three years, . . . or to be imprisoned for any term not exceeding two years.' As the intent in these cases is to perpetrate *robbery*, and not murder, another section (21) has been framed, for the prevention of the crime of *garoting*: 'Whosoever shall, by any means whatsoever, attempt to choke, suffocate, or strangle any other person, or shall, by any means calculated to choke, suffocate, or strangle, attempt to render any other person insensible, unconscious, or incapable of resistance, with intent, in any of such cases, to enable himself, or any other person, to commit, or with intent in any of such cases thereby to assist any other person in committing any indictable offence, shall be guilty of felony; and being convicted thereof shall be liable, at the discretion of the court, to be kept in penal servitude for life, or for any term not less than three years, . . . or to be imprisoned for any term not exceeding two years,' &c.

Marks of Violence.—It may be inquired whether *marks* of violence on the body, or blood-stains on the clothes, furniture, or in the apartment, do not afford strong evidence of *homicidal* strangulation. The answer is—if the marks of violence are such that they could not possibly have arisen from any accident before death, or that they could not possibly have been self-inflicted, they afford the strongest evidence of murder. But the cases wherein so positive an answer can be returned are exceptional. It is not always in our power to distinguish *accidental* or *self-inflicted* from homicidal violence; and we are always bound to look to the probability of accident or of previous attempts at suicide being the source of those injuries which may be apparent on a strangled body. There may be *several marks* on the neck, but then the person may have tried to strangle himself more than once. The throat may be cut; there may be a deep-seated stab or gunshot-wound, involving some of the important organs of the body; or poison may be found in the stomach; but in a purely medical point of view, how are we to know that the deceased did not actually make the marks, inflict the wounds, or take the poison before he succeeded in strangling himself? In the chapters on Drowning and Hanging, we have seen what suicides can do when they are desperately bent on destroying themselves. Wounds and personal injuries often create serious difficulties to a medical jurist, which it requires the greatest caution and prudence on his part to meet and explain. The prejudice of the public mind is such, that the discovery of a strangled person, with any marks of personal injury or of poisoning in his stomach, would, in most cases, lead to a charge of murder, unless the facts rendered it clearly impossible that any attempt could have been made on his life. It is against this prejudice that a medical witness must strenuously guard himself; he may be abused for not joining in the outcry of the vulgar, but the best recompense for this abuse will be the conviction that he is interposing the shield of science to protect a possibly innocent fellow-creature from the senseless denunciations of ignorance. Further, before a charge of murder by strangulation is raised against any person from marks or appearances found on a dead body, care should be taken that they admit of no other reasonable explanation than the direct application of violence. Even if marks indicative of strangulation are discovered, the question arises whether they may not have been produced by the deceased upon himself in an attempt at suicide which may have failed. If the body of a person is allowed to cool, with a handkerchief, band, or tightly fitting collar round the neck, a mark resembling that of strangulation will be produced. Before any opinion is given that murder has been perpetrated or attempted, the medical proofs on which reliance is placed should be clear, distinct, conclusive, and satisfactory.

In the dead bodies of infants and children, in whom the neck is short, a mark is occasionally seen which arises from the bending of the head; and in short-necked persons a similar mark or depression has been noticed after death, in front of the neck. This mark may also be produced by the pressure of a cap-string. These marks are then rendered more prominent by their assuming a livid appearance. They might, at first, be mistaken for marks produced by a ligature in an attempted strangulation. In one case a death from apoplexy was attributed to homicidal strangulation from a cadaveric change of this kind. ('Ann. d'Hyg.,' 1859, t. 1, p. 139, and t. 26, p. 149.) The matter was set right by Ollivier. Homicidal strangulation may be perpetrated on the weak and infirm without causing any noise or creating alarm. In the first place, if the throat is at once seized and firmly compressed, no cry can be made, nor any noise produced to excite the attention of those who are near. An aged woman was strangled in her shop by an apprentice in so short a time and so quietly, that her husband, who was only separated from her by a slight partition, heard no noise or disturbance during this act of murder. ('Ann. d'Hyg.,' 1859, t. 1, p. 157.)

It cannot be disputed that, in contested questions of suicidal or homicidal strangulation, rare as they are, we must be often greatly indebted to evidence founded on circumstances, as well as to moral presumptions. How far a medical jurist may be allowed to make use of these in the formation of an opinion, it will be for the court to determine. Generally speaking, his duty is rigorously confined to the furnishing of medical evidence from medical data alone; but instances present themselves in which this rule must be departed from, or the course of justice will be impeded. Besides, there are numerous circumstances of a collateral nature which may materially modify a medical opinion. Thus the sight of a ligature, the state of the dress, and the attitude of the deceased when discovered, although not strictly medical circumstances, bear directly upon medical opinions; and that evidence ought not to be objected to which is partly founded upon facts of this nature. It must occur to all that, without circumstantial evidence, the best medical opinion in these cases will often amount to nothing. It may be, for example, no more than this: the case is either one of homicide or suicide; and why is such an indefinite answer to be returned? Because, in the abstract view of strangulation, it is not easy to determine whether a ligature was *suicidally* applied round the neck or not. The appearances may be in many cases the same, and, where they are different, this difference may be due to accident, so that it is a mistake to suppose that we must look to medical circumstances *alone* for clearing up this intricate question. On some occasions the theory of homicide or suicide will be equally consistent with the facts. The cases of *Dr. Franck* and his son, which occurred at Brighton in 1855, were of this ambiguous character. Whether the son strangled himself, or was strangled by his father, was a question which could not be satisfactorily solved by medical, moral, or circumstantial evidence. Unfortunately, the bodies did not undergo a proper medico-legal inspection.

In all fatal cases resulting from acts of suicide, the means by which strangulation was produced will be found upon the neck. The condition of the mark on the neck, the course and direction of the cord, the mode in which it was secured or fixed in order to produce effective pressure on the windpipe, the amount of injury to the muscles and parts beneath, are circumstances from which, if observed at the time, a correct medical opinion may generally be formed. If the means of constriction are removed, or the cord or ligature is loosely applied, these facts, unless explained, are presumptive of homicidal interference.

There is another condition in which a presumption of homicide will be justifiable. A man, in strangling himself, is not likely to vary the means. The act is commonly due to a sudden impulse, if we may judge from the moral proofs afforded in the instances on record. The article which is nearest to the suicide is seized, and made the instrument of self-destruction. It has already been stated as doubtful whether a person could strangle himself by the mere application of the fingers to the windpipe; the discovery of such *marks only* as would indicate this kind of strangulation, therefore, renders suicide in the highest degree improbable. But these marks may be sometimes ascribed to the deceased having fallen with his hand possibly applied to his neck, and the inference will be drawn that they have accidentally resulted from the pressure of his own fingers. This is an improbable mode of accounting for the production of ecchymosis or excoriation of the skin in front of the neck. If, besides these marks of fingers, we find a circular mark, with a ligature still around the neck, the presumption of murder becomes very strong. It may be said that a person might at first try to strangle himself with his fingers, and, not succeeding, might afterwards employ a cord. But the degree in which the coincidental impressions exist will in general remove this objection.

Imputed Strangulation.—Hitherto the subject of strangulation has been considered in reference to the dead. But a living person may charge another with attempting murder under such circumstances, and here a medical jurist will have the not very arduous duty of detecting and exposing the imposture. It has been considered so improbable that any one would seriously attempt to strangle himself, and then impute the act to another, that medical jurists have given but little attention to this subject. A case tried in France in 1864 (*Affaire Armand et Maurice Roux*), has shown the great importance of it, and how easily medical men and the public may be deceived by a plausible story (*post*, p. 442). As in reference to imputed wounds, so in these cases impostors rarely produce such injury to themselves as to place their lives in jeopardy. The cord is loose round the neck, or there would be speedy death; it is not so secured as to press with great force on the air-passages, to cause the tongue to protrude, or to produce lividity of the face and neck, or ecchymosis in the conjunctivæ and the skin. It is either a ligature or a rope which is used by the impostor: he does not commonly resort to manual violence to his throat. The marked feature of a really homicidal attempt is in the great amount of violence done to the neck; and the account given by the impostor will be inconsistent in its details, and not reconcilable with the ordinary effects of homicidal strangulation. Tardieu met with a case, in which a young woman of good social position, wishing to excite some public sympathy, alleged that she had been made the victim of a political conspiracy. One evening she was found at the door of her room apparently in a very alarming state: she could not speak, but indicated, partly by gestures and partly by writing, that as she was entering her room a man had attempted to strangle her by pressing his hand upon her neck, and at the same time had stabbed her in the chest with a dagger. On close examination, it was found that there were two stabs which had penetrated only through the outer clothing. But the most singular effect of the alleged attempt at strangulation was that, instead of producing a difficulty of speaking and alteration of the voice, it had been followed by complete dumbness. Tardieu could find on the neck no trace of any attempt at strangulation; and on assuring the young lady that the loss of voice under such circumstances could not last for more than a minute, she at once admitted that there was no foundation for the charge. ('Ann.

d'Hyg., 1859, t. 1, p. 163.) On this occasion no person was accused; but the case is different when, for the purpose of extortion or other base motives, one or more persons are charged with an attempt at murder. A flagrant instance of this kind occurred in France, in which a wealthy merchant of Montpellier was charged by his servant, *Maurice Roux*, with having attempted to murder him by strangulation. The case was tried in March, 1864, before the Court of Assizes of the Bouches du Rhone; and, fortunately for the interests of justice as well as for the credit of medico-legal science in France, it ended in a complete acquittal of the accused. (*Affaire Armand et Maurice Roux*, Paris, 1864; 'Relat. Med.-Lég. de l'Affaire Armand,' &c., par Tardieu; 'Ann. d'Hyg.,' 1864, t. 1, p. 415.)

It may be observed, in reference to these imputed cases, that men who deliberately strangle others either draw a cord tightly or secure it by a knot. The pressure to the neck is not so gentle as to leave no mark whatever, or to allow the strangled person to breathe and watch all that goes on around him. Slight marks of violence about the neck should be therefore viewed on these occasions with great suspicion. If, as is most improbable in attempted homicide, the cord is left only loosely coiled around the neck, the person assaulted necessarily retains the power of breathing and calling for assistance; but if the hand of a murderer has been at work, it is effectually tightened, and the person dies in a few minutes. A charge of this kind, where there can be no witness but the person making it, requires to be supported, not by medical probabilities, but by the strongest medical facts. These ought to show that there are marks of violence on the neck such as an assassin would be likely to inflict, and, at the same time, such as the person making the charge would not be likely to produce, or have the power of producing, on himself.

SUFFOCATION.

CHAPTER 41.

SUFFOCATION FROM MECHANICAL CAUSES.—CAUSE OF DEATH.—APPEARANCES AFTER DEATH.—EVIDENCE OF DEATH FROM SUFFOCATION.—ACCIDENTAL, SUICIDAL, AND HOMICIDAL SUFFOCATION.—SMOTHERING.

By suffocation we are to understand that condition in which air is prevented from penetrating into the lungs, not by constriction of the windpipe, but by some mechanical cause operating on the mouth externally, or on the throat, windpipe, or air-passages internally. In this sense it will be perceived that drowning is one form of death from suffocation, the water being an effectual medium for preventing access of air to the lungs.

The term 'suffocation' is applied to various conditions in which the symptoms and effects differ. There may be a simple privation of air; the air respired may not be renewed from the want of proper ventilation; or the air which is breathed may be mixed with certain noxious gases or vapours, which, by absorption into the blood through the air-cells of the lungs, may destroy life like poisons. The symptoms preceding death, the disposition to recovery, and the post-mortem appearances in fatal cases, will differ under these circumstances. It will be sufficient at present to consider the most simple form of suffocation which is within the reach of experiment, namely, that which depends on the privation of air by substances blocking up the air-passages, or by the covering of the mouth and nostrils. A Committee of the Medico-Chirurgical Society performed a series of experiments on dogs, in which a tube was inserted into the windpipe, and breathing either took place or was completely arrested, according to whether the tube was kept open or closed by an accurately fitting plug. When the tube was closed, the animal, after a variable number of seconds, made strong efforts to breathe; and when these ceased, unless air was speedily admitted, it died. From nine experiments on the dog, the average duration of the respiratory movements, after the animal had been completely deprived of air, was four minutes and five seconds. The average duration of the heart's action was seven minutes and eleven seconds; and it further appeared that, on an average, the heart's action continued for three minutes and fifteen seconds after the animal had ceased to make these efforts to breathe. In respect to the rapidity with which death takes place in animals, the following conclusions were drawn: first, a dog may be deprived of air during a period of three minutes and fifty seconds, and afterwards recover without the application of artificial means; and second, a dog is unlikely to recover, if left to itself, after having been deprived of air during a period of four minutes and ten seconds. As in drowning, the shorter the interval between the last respiratory efforts and the readmission of air, the greater the probability of recovery. ('Med.-Chir. Trans.,' 1862, vol. 45, p. 454.) The results of these experiments in reference to the duration of life under privation of air may be considered applicable to a human being. It is not likely that a man would survive under these circumstances longer than a dog, and it may therefore be fairly inferred that the life of a man would be destroyed in from four to five minutes after the power of breathing had been completely arrested.

There are many varieties of death by suffocation, all of which are of great medico-legal interest:—1. The close application of the hand over the mouth and nostrils, or the placing of a plaster or cloth over these parts, combined with pressure on the chest: this was formerly not an unfrequent form of homicidal suffocation. 2. Smothering, or the covering of the head and face with articles of clothing, &c., which effectually prevent breathing. 3. The accidental or forcible introduction of foreign bodies into the mouth and throat. 4. The flow of blood into the windpipe from a severe wound in the throat, or from the bursting of a blood-vessel or aneurismal sac. 5. In wounds of the throat, when the windpipe is completely divided, the lower end may be so drawn into the wound as to produce a closure of the orifice, and intercept the passage of air. One or other of these causes frequently operates to render a wound in the throat fatal. 6. The plunging of the face into mud, snow, dust, ashes, feathers, leaves, or similar substances. In all these cases death takes place from asphyxia, and with great rapidity, if the chest sustains at the same time any degree of forcible compression. 7. Swelling or spasm of the glottis produced by the contact of corrosive liquids or boiling water. In one case death was probably caused by the application of a strong solution of mercuric nitrate to an ulcer in the throat.

Suffocation may arise from *morbid causes* operating mechanically to prevent respiration, such as a diseased state of the parts about the throat, an enlargement of the glands, the bursting of a tonsillary abscess, or the effusion of lymph, blood, or pus into the windpipe, or about the opening of the larynx (rima glottidis). Any of these causes may suddenly arrest the act of breathing—a fact which can only be determined by a careful examination of the air-passages. Accidental suffocation may arise from large masses of food blocking up the larynx. If the glottis (the opening of the windpipe) be completely closed by food, death may take place suddenly; although the person so situated may be capable of making some exertion or of moving from the spot. Mackenzie relates a case in which a man was suddenly choked by swallowing a large piece of meat: he immediately walked across the street to a chemist's shop, and, soon after entering it, he fell down in a state of insensibility. After death, the throat was found to be filled with a piece of beef, which rested on the glottis, and had pressed the epiglottis forward. Part of the mass had entered the windpipe through the rima glottidis, and had thus caused death by suffocation. It is probable that, in this and similar cases, the foreign body does not so completely close the aperture as to prevent some degree of respiration, but, the blood being imperfectly aërated, asphyxia is speedily induced. ('Edin. Month. Jour.,' July, 1851, p. 68.) A man, æt. 31, was put to bed drunk, having previously vomited; and shortly afterwards he was found dead. On inspection, Jackson discovered the usual appearances of asphyxia, *i.e.* congestion of the lungs and of the right cavities of the heart. He was thus led to examine the air-passages carefully, and he found lying over the upper opening of the larynx (rima glottidis) a thin and transparent piece of *potato-skin* so closely applied to the fissure as to prevent breathing. The man had died accidentally suffocated from this mechanical cause. He had had potatoes for dinner the day before; the piece of skin had probably been thrown up at the time of vomiting, and had been drawn back by inspiration into the singular position in which it was found. Owing to intoxication, the deceased was unable to cough it up. ('Edin. Med. and Surg. Jour.,' April, 1844, p. 390.) Wright describes the case of an old woman who, during a violent fit of coughing, suddenly fell back in her bed, struggled convulsively, and died in a few seconds. After death, a pellet of tough mucus was found in the rima glottidis, so that the deceased was literally suffocated with her own phlegm. ('Pathol. Researches,' 1850, p. 7.) A man was suffocated while at dinner by swallowing his artificial teeth. In another case, a man died from suffocation by swallowing an oyster. In the case of a child, æt. 8, it was proved that suffocation had been caused by a gooseberry which had been swallowed, blocking up the glottis. In the 'Lond. Med. Gaz.,' vol. xxix. p. 146, there is a case reported in which a child was suffocated by a pea.

A person may die suffocated, not from the act of swallowing food, but by reason of part of the contents of the stomach finding their way into the air-passages. Whenever vomiting is followed by an inspiration while the vomited matters are in the mouth, the food is liable to be drawn by aspiration into the windpipe, bronchi, and pulmonary cells, and to cause suffocation. Pressure on the body may have the same effect as the act of vomiting. A man was struck several blows with the fist; he was then stabbed in the nape of the neck, and finally his body was trampled on by his assailants. He died before any assistance could be rendered. On inspection, the air-passages were found to contain a large quantity of pulpy matter such as existed in the stomach. The wounds received were only flesh wounds, no large blood-vessel having been injured. Nevertheless, one expert attributed death to loss of blood from the wounds; another assigned it to asphyxia from the food vomited by the deceased passing into the lungs during an inspiration. Engel and Hauska were able to prove that asphyxia was the cause of death, and that the assailants were responsible. The food had been forced into the fauces by the act of trampling on the body. ('Ann. d'Hyg.,' 1868, t. 1, 450; and t. 2, 226; 1869, t. 1, 471.) This mode of death by suffocation, as a result of violence to the abdomen, is probably more frequent than it is commonly supposed to be. It is likely to occur in the maltreatment of drunken persons. Behrend has reported a case in which suffocation was caused by the aspiration of food, with a full account of the post-mortem appearances, in Horn's 'Vierteljahrsschrift,' 1868, 1, 123. Accidental suffocation from food is one of those causes of violent death which is recorded in the Registrar-General's returns. It appears from the report of mortality in England and Wales that in one year there were 81 deaths from this cause.

A person has been wrongly charged with causing the death of another, when the cause was really owing to the impaction of food in the larynx. An instance of this kind ('Lancet,' 1850, i. p. 313) occurred at Hillingdon. The deceased had a quarrel with the accused, and they were seen to fall to the ground together, while struggling and fighting. They were separated. About two hours afterwards, the deceased, who appeared quite well, was observed to rise from the dinner-table and leave the room. He was found leaning against the cottage, as if in a falling position, and he expired in two or three minutes. The person with whom the deceased had been fighting was charged with manslaughter before a magistrate. At the inquest, the medical witness stated he found the organs of the body, excepting the brain, in a very healthy state. The brain was excessively congested, and he attributed death to apoplexy. The coroner desired the witness to examine the mouth and throat (which he had omitted to do at the inspection), as, from the suddenness of death after eating, he (the coroner) thought the man might have been choked. This opinion turned out to be correct. A large piece of meat was found wedged in the opening of the throat: this had caused death by suffocation. It had not completely closed the air-passages in the first instance: hence the man was able to move from the dinner-table. The person accused of manslaughter was discharged. A medical jurist, however, must not lose sight of the fact that a foreign substance may be *homicidally* impacted in the larynx, and that, except by a careful examination of the body, death may be wrongly assigned to accident. A case reported by Littlejohn is in this respect instructive. In examining the body of a woman who it was stated had died suddenly, he found a quart-bottle cork inserted tightly into the upper part of the larynx. The sealed end was uppermost, and was roughened by the passage of the screw. Fractures of the ribs were found, and it was quite clear that deceased had not died a natural death. It was suggested that the deceased, while extracting the cork from the bottle with her teeth, might, by the sudden impetus of the contained fluids, have drawn it into the position in which it was found. But this theory was negatived by the sealed end of the cork being uppermost in the throat, as well as by the structure of the parts. The medical opinion was that the cork must have been forcibly placed there by another person, while the woman was in a helpless state of intoxication. There was no reason to doubt that this was a deliberate act of murder. Five persons were present with the deceased at the time of her death, but it was impossible to fix with certainty upon the person who had committed the act, and the man on whom the strongest suspicion fell was acquitted on a verdict of 'not proven.' ('Edin. Med. Jour.,' Dec. 1855, p. 511; and for a report of the trial, see p. 540.)

Cause of Death.—In suffocation, death takes places from asphyxia; and this occurs with a rapidity proportioned to the degree of impediment existing to the passage of the air. There does not seem to be any reason to attribute death to apoplexy. The congestion of the cerebral vessels may be regarded as a consequence of the disturbance of the functions of the lungs. If the veins of the neck were opened, so as to prevent an accumulation of blood in the vessels of the brain, it is pretty certain that the prevention of respiration would destroy life under the same circumstances and within the same period of time; therefore we may regard death from suffocation as resulting from pure asphyxia. In treating a case of suffocation, we have simply to allow of the renewal of air by removing, if this be possible, the mechanical obstacle to respiration. The results of experiments on dogs show that, even with a perfect closure of the windpipe, an animal may recover spontaneously after nearly *four minutes'* deprivation of air; and there is every reason to believe that a human being might recover after the same length of time. If five minutes have elapsed, there will be less hope of recovery. In drowning, the chances of recovery continue only for half the period observed in suffocation; the lungs are injured, and the water by which they are penetrated forms a physical obstacle to the free admission of air. In hanging and strangulation, there is sometimes great violence done to the parts about the neck. In suffocation, these accidental obstacles to recovery do not exist—the surgeon has simply to readmit the air into the lungs. All experiments go to show that, even in this form of asphyxia, which is most favourable for recovery, the complete suspension of respiration for *five minutes* is fatal. Hanging and strangulation prove fatal from asphyxia within the same period of time, and drowning within a shorter period.

Vierordt has shown that the spectroscope will enable a skilful observer to note the time at which life has passed into death, and whether there is a probability that life can be restored after a certain interval. If the fourth and fifth fingers are placed one over the other in a living body, and the line of union is brought before the slit of a spectroscope against the sunlight, or a very powerful light, the two absorption-bands of oxy-hæmoglobin will be visible (p. 269). In the body of one really dead, whether from asphyxia by suffocation or any other cause, only one band, that of deoxidized hæmoglobin, will be seen. Vierordt found that, even in the living body, by a compression of the fingers, local death by the withdrawal of oxygen takes place rapidly, and the two bands pass into one. On removing the temporary pressure, the oxygenated blood again circulates, and the two bands are restored.

Post-mortem Appearances.—There are rarely any considerable marks of violence externally. When the body has become perfectly cold, there may be patches of lividity diffused over the skin; but these are not always present. Tardieu has found upon the skin of the neck, face, and shoulders, dotted or punctiform ecchymoses. ('La Pendaison la Strangulation et la Suffocation,' p. 267.) The lips are livid; the skin of the face and neck may be pale or present a dusky-violet tint, with small patches of ecchymosis. The eyes are congested; there is a mucous froth about the lips and mouth. The mouth, throat, and parts about the windpipe should be carefully examined for foreign substances. Internally, the lungs and right cavities of the heart may be found distended with blood. The state of the lungs and heart is, however, subject to variation. The lungs are not necessarily found congested; and sometimes, as in a case referred to the author in 1864, one lung may be found congested and the other not. In 1883, a terrible catastrophe occurred in Sunderland, whereby about two hundred children lost their lives by suffocation. By the closing of a door, the children, pouring down a staircase, trampled one another to death, their bodies being heaped upon one another to a height of several feet. The same characteristic appearances were observed in nearly every case, namely, a congested, puffy face, purple or blackish turgescence of the vessels of the neck, closed eyelids, protruding and fixed eyeballs, pupils dilated to the utmost, bloody froth issuing from the nose and mouth, giving the appearance of an intense degree of suffering and anxiety; yet in twenty-four hours after death, much of this passed off, and the face exhibited a slight smile, as if in sleep. ('Brit. Med Jour.,' 1883, i. p. 1248.) Tardieu states, from his observations, that the *lungs* are of a reddish colour, sometimes pale, and not distended, and presenting occasionally only a slight degree of congestion at the base and posteriorly. A special character which he states he has invariably noticed in these organs consists in the presence of small ecchymosed spots or patches beneath the pleura or investing membrane. He describes these spots as of a dark colour, and varying in size from a pin's head to a lentil. In the adult they are of still larger size. Their number is variable; sometimes five or six may be found, at others twenty or thirty, and in other cases the surface of the lung may be so studded with them as to give to it a granite-like appearance. These spots of ecchymosis are sometimes agglomerated, at other times separated, but their outline is generally distinct and well defined on the surface of the lungs. They are most frequently seen at the root of the lungs, at their bases, and about their lower margin. They are owing to small effusions of blood from ruptured vessels, like true ecchymosis. They may be distinguished so long as the tissue of the lungs remains unchanged. Tardieu states that he has seen these subpleural ecchymoses in the lungs of an infant which had been lying ten months in the soil of a privy. He admits, however, that they may also be found in the lungs of children that have not breathed; hence no inference of death from suffocation should be drawn from this appearance in the lungs, unless they have actually received air. In three instances he met with subpleural ecchymoses in lungs which sank in water, and had all the usual characters of these organs in a fœtal state. The children had been born living, prematurely, and under conditions in which life by respiration could not be perfectly established: one of them had made several cries without effectually receiving air into the lungs. (See Casper's 'Klin. Novellen,' 1863, p. 471.) This struggle to breathe may have produced the appearance resembling that of suffocation. In new-born children that die from suffocation, the thymus gland has been found in a similar condition. The same appearance may be produced during the birth of a child by pressure on the navel string, when this is prolapsed whilst the head of the child is passing down the vagina. The value of medical evidence derivable from the presence of subpleural ecchymoses in the lungs has been also investigated by Legroux. ('Ann. d'Hyg.,' 1878, t. 2, pp. 174 and 335.) He believes: 1. That they may be seen in the lungs under various conditions, independently of the cause of death. 2. They are met with in different degrees in the different forms of death by asphyxia. 3. Unless accompanied by other indications of the mode of death, their presence will not enable us to determine the cause. In death from suffocation they are very numerous, from strangulation less numerous, and from hanging least numerous. 4. The presence of subpleural ecchymoses indicates a rapid and violent death, whether the violence be from internal or external causes. A Committee of the Société de Médécine Légale was appointed to examine the value of this post-mortem appearance as a positive indication of death by suffocation. They reported: (1) that subpleural ecchymoses may arise from spontaneous conditions irrespective of the cause of death; (2) that they may be met with in violent asphyxia by hanging, strangulation, submersion, by compression of the chest, and by suffocation, but in different degrees; (3) they are of value only when associated with other signs indicating the mode of death. ('Lancet,' 1878, ii. p. 305.)

According to Tardieu, this dotted appearance of the surface of the lungs in suffocation is not attended with the apoplectic effusions in their substance which are met with in death from strangulation. Emphysema, or escape of air from rupture of the air-cells, is occasionally observed. The more rapidly suffocation has taken place, the more strongly marked are these ecchymosed spots. On the other hand, when the interruption of breathing has been slow and gradual, the substance of the lungs is more congested with blood, and then these dots or patches are merged in the general violet colour of the surface of the organs. The lining membrane of the windpipe and larger air-tubes is sometimes pale, but commonly dark-coloured when the lungs are congested. In the air-passages there is occasionally a frothy, reddish-coloured liquid in small vesicles.

Liman disputes the accuracy of the observations of Tardieu regarding this appearance described by him as characteristic of death from suffocation. ('Ann. d'Hyg.,' 1867, t. 2, p. 388.) According to Ogston, sen., the subpleural or punctiform ecchymoses observed by Tardieu were not present in the cases of nine adults who had died from suffocation. ('Brit. Med. Jour.,' 1868, ii. p. 332.) On the other hand, they may be found in cases in which death has taken place from drowning, hanging, and strangulation. Too much reliance must not, therefore, be placed on their presence or absence. These spots of ecchymosis were found by Ogston, not only on the surface of the lungs, but on the heart, the scalp, the pericranium, the thymus gland, and other parts. That they are frequently absent in death from suffocation is shown by the observations of other medical jurists. (See 'Vierteljahrsschr. für Gerichtl. Med.,' 1867, 2, p. 146.) In an elaborate paper published in the same journal, Lukomsky has endeavoured to show, by a variety of experiments, the circumstances under which we may expect to find these ecchymoses in death from suffocation, and the cases in which they are likely to be absent. ('Vierteljahrsschr. für Gerichtl. Med.,' 1871, 2, p. 58.)

Page, who has experimented on this subject, agrees with the above-named medical jurists in considering that Tardieu has been too hasty in making these dotted or subpleural ecchymoses a certain diagnostic sign of death from suffocation. According to him, they probably arise from the continued and violent efforts to breathe in the early stage of asphyxia. Their occurrence in the lungs of a hanged person would not, therefore, justify the inference that the person had been first suffocated and afterwards hanged. The same remark applies to drowning. Page found, on drowning animals, that subpleural ecchymoses were so numerous on the lungs as to give to the organs a granitic aspect. ('On the Value of Certain Signs of Death from Suffocation,' Edinb., 1873.) He has drawn the following conclusions from his experiments:—1. The ecchymoses or patches of extravasated blood found on the surfaces of certain internal organs, and notably of the lungs, are not peculiar to any one mode of death by asphyxia, but are common to all. 2. The ecchymoses are not, therefore, diagnostic of death from suffocation. 3. They probably occur with greater frequency in suffocation, owing to the absence of interference with the cerebral circulation, and the opportunity which the means usually employed afford for respiratory struggles.

The *heart* presents no special appearance indicative of the mode of death, if we except the presence of small spots of ecchymosis found below the investing membrane, like those met with on the lungs. They have been found near the roots or origin of the great vessels, but are not so frequently observed in this organ as in the lungs. The blood is generally dark and fluid; but sometimes coagula are met with. The stomach and intestines have been observed to present patches of lividity. Casper has found the kidneys more strongly congested with blood than the liver, spleen, and other organs. The vessels of the *brain* are sometimes congested, but at other times they do not appear to be more than ordinarily full. Their condition may be affected by the congested state of the lungs, as well as by the slowness or rapidity with which death takes place. Other appearances which have been described are of an accidental nature, and are not connected with death from suffocation.

In a case of alleged murder by suffocation, respecting which the author was consulted in 1857, the following appearances were met with. The body was lying on the bed: the right leg was drawn up towards the body; the right arm was bent, with the hand directed towards the face; the left hand was lying upon the chest. The lips were livid, the tongue protruded and swollen, and there was a bloody fluid issuing from the nostrils. There was no mark of constriction on the neck; the eyes were half-open; the body was rigid and still warm. The face and neck were much swollen, and the skin of these parts, as well as of the chest, abdomen, arms, and legs, was covered with dark livid patches. The brain was gorged with venous blood. The lungs were congested. The heart was soft and flaccid, and its cavities were empty. The mucous membrane, as well as the tissues of the air-passages, were much congested with dark liquid blood—the blood was everywhere liquid. The stomach contained a small quantity of dark-coloured liquid, and the greater end was reddened. The spleen was congested. The emptiness of the cavities of the heart was at first considered to be inconsistent with death from asphyxia; but this condition of the heart is occasionally found. It may be stated that in this case the deceased, a female, was greatly exhausted by sickness and purging. On the second day of her illness she was found dead in the state described, and her husband was charged with having suffocated her.

Evidence of Death from Suffocation.—In medical jurisprudence there is not, perhaps, an instance in which we have fewer medical data upon which to base an opinion than in a case of alleged death from suffocation. The inspection of the body of a person suffocated, if we except the peculiar condition of the surface of the lungs described by Tardieu, presents so little that is peculiar, that a medical man, unless his suspicions have been roused by circumstantial evidence, or by the discovery of foreign substances in the air-passages, would probably pass it over as a case of death without any assignable cause—in other words, from *natural causes.* In examining the body of the woman *Campbell,* who was suffocated by *Burke* in Edinburgh, Christison was unable to come to a conclusion respecting the cause of death until some light had been thrown on the case by collateral evidence. On this occasion, a violent death was suspected, because there were marks of violence externally, and the face of the deceased presented some of the characters of strangulation. These conditions, however, are by no means essential to death from suffocation, and when they exist they can only be regarded as purely accidental accompaniments. Appearances similar to those found in the bodies of suffocated persons, if we except the dotted ecchymoses on the lungs, are frequently met with in inspections when death has taken place as a consequence of disease or accident. They can, therefore, furnish no conclusive evidence of the kind of death; they scarcely permit a witness to establish a presumption on the subject, until, by a careful examination of the body, he has ascertained that there is no other cause of death depending on organic disease or on violence. Medical evidence may, however, be serviceable in some instances. Thus, let the general evidence establish that a deceased person has probably been suffocated, the witness may have it in his power to state that the appearances in the body are consistent with this kind of death; that the body is in all respects healthy and sound; and that death was probably sudden—as where, for instance, undigested food is discovered in the stomach. The presence of ecchymoses on the surface of the lungs may justify an opinion of death by suffocation when no other cause is apparent. In all cases of this description, we must bear in mind that an opinion relative to the supposed cause of death is to be formed from the *medical* circumstances and from what we have ourselves seen, unless it be otherwise allowed by the court. From this want of clear evidence, a great difference of opinion on the cause of death frequently exists among medical witnesses.

Accidental suffocation is not unfrequent; and there are various conditions under which a person may die suffocated, only discoverable after death. 1. Diseases about the tongue, larynx, or throat may have advanced to such an extent as effectually to prevent breathing. 2. The deceased may have fallen, and the mouth become covered with dust, ashes, mud, or other substances; and if helpless, as in the case of an infant or an aged person, or of one who is intoxicated, death may thus easily take place. A child was found dead in a room, with its face in the ashes under a grate; it had fallen during the absence of the mother, and, from its helpless condition, had speedily become suffocated. Some of the ashes were found in the windpipe. ('Lond. Med. Gaz.,' vol. xvii. p. 642.) In 1878, a boy died from suffocation under the following circumstances. He was playing in a corn-loft with some companions, when, in order to hide himself, he got into a wheat-bin about eight feet deep. He was drawn through the wheat towards the machine and was thus buried in the corn. Although extricated in a few minutes, he was quite dead. In trials for murder or manslaughter, a medical opinion respecting the accidental suffocation of a drunken person under similar circumstances is occasionally required. These persons, it must be remembered, are generally as helpless as children; if they fall in a position so that the mouth is covered, they may be so powerless from intoxication as not to be able to escape. A case was brought into Guy's Hospital in 1870, in which a man subject to epileptic fits had lost his life by accidental suffocation. He was found dead, lying with his face in a quantity of mud. On a post-mortem examination, the teeth and nostrils had liquid mud adhering to them, and the tongue was thickly coated with it. The right side of the heart was full of blood, and there was a large quantity on the left side extending into the aorta. The blood, as is frequently the case in sudden death, was liquid. There were a few gritty particles in the windpipe, but no froth. There was no doubt that the man had died from asphyxia, as a result of accidental suffocation during a fit. ('Lancet,' 1870, ii. p. 82.) In 1877, an inquest was held in London in which it was proved that the deceased was found dead in bed, lying with his face downwards and one arm under his head. The medical evidence showed that the cause of death was suffocation, by reason of the deceased having turned with his face to the pillow, and so covered his mouth and nostrils. 3. A portion of food may have remained fixed in the larynx or throat. Children are sometimes accidentally suffocated by drinking boiling water from a tea-kettle. The parts about the larynx then become swollen from the action of the hot water, and breathing cannot take place. 4. Accidental suffocation is not uncommon among infants, when they sleep with adult persons (overlaying). A child may be in this way speedily destroyed. Even the close wrapping of a child's head in a shawl, to protect it from cold, may effectually kill it, without any convulsive struggles to indicate the danger to which it is exposed (p. 455, *post*). Convulsions by no means necessarily attend on death from suffocation.

Those instances of accidental suffocation which depend on disease or on the impaction of food, are easily known by a careful examination of the parts about the throat; generally speaking, they present no difficulty. In other instances, when a child or a drunken person is presumed to have been suffocated owing to the position in which he has fallen, evidence as to the position of the body, or even the actual sight of the body, is necessary before forming an opinion. The following questions may here arise: Was the position such as to be explicable on the supposition of accident? Was it not such a position as might have been given to it by a murderer? Could not the deceased have had strength or presence of mind to escape? Could he have been actually suffocated in the position in which his body was discovered? A little reflection upon the circumstances—for here something more than *medical* facts will be required—may enable us to give satisfactory answers to these questions.

Some singular cases are on record, in which persons have wilfully destroyed themselves by blocking up the throat mechanically. An instance of this form of *suicide* is reported. ('Edin. Med. and Surg. Jour.,' April, 1842, p. 391.) A woman confined in prison forced a hard cotton plug into the back of her throat. The cavities of the chest and abdomen had been already examined, and a medical certificate given that the deceased had died of apoplexy. The body was sent to one of the anatomical schools, and on reinspection it was accidentally found that the throat was firmly blocked up with a plug of spindle-cotton.

Homicide by suffocation is not very common, although it is a ready means of perpetrating murder. Hitherto the cases which have come before our courts have been those either of infants, or of the aged and infirm, or of persons enfeebled by illness. In regard to the latter, the rigorous administration of the law has succeeded in putting a check to this crime; but with respect to children, it probably yet continues. Death by suffocation is most difficult to detect; and, unless the assailant has employed an unnecessary degree of violence, it is probable that the crime may pass altogether unsuspected. Homicide by suffocation would not be attempted on healthy adult persons, unless they were in a state of intoxication, and thereby rendered defenceless. It is certain that most individuals would have it in their power, unless greatly incapacitated by disease or intoxication, to offer such a degree of resistance as would leave upon their bodies indubitable evidence of murderous violence. Death from suffocation may be considered as presumptive of homicide, unless the facts are clearly referable to accident. Accidental suffocation is, however, so palpable, from the position of the body and other circumstances, that when death is clearly traced to this cause, it is not easy to conceive a case in which it would be difficult to distinguish it from one of actual murder. In some instances, the very means that have been adopted to produce suffocation may forbid the supposition of accident, and clearly establish the fact of homicide.

The suffocation of new-born children, by the introduction of substances into the mouth, is not unfrequent. The unnecessary force employed generally leave traces of violence, which may be easily discovered by a careful examination, even should it happen that the substance used for the murderous purpose has been removed. A child, one year old, after it had been fed with a bottle, was put to bed at six o'clock, and died at midnight with signs of dyspnœa. On inspection ten hours after death, the lower lobes of the lungs were found softened, of a greyish colour, and apparently pulpy. Curdled milk was found in the windpipe and bronchi. There was no doubt that the milk had been vomited after the child was put to bed, and, on account of the horizontal position, a portion of it had been drawn by aspiration into the air-passages, and had caused suffocation. ('Lancet,' 1873, i. p. 669.)

It is necessary to point out a dangerous practice common among ignorant nurses, which, without exciting suspicion on the part of a coroner or medical witness, may be an occasional cause of death in infants. In order to quiet a child, and to enable a nurse to sleep without disturbance, a bag made of wash-leather or rag, containing sugar, is thrust into the child's mouth. It is thus completely gagged, and the child soon becomes quiet, respiring chiefly through the nostrils. If these by any accident become obstructed, or by the act of aspiration the bag should fall to the back of the throat, death from suffocation results, the infant being helpless. The suspension of breathing may be so gradual that the child may die without crying or convulsions. The removal of the bag from the mouth, as no violence has been used, will remove every trace of the cause of death; and, in order to exculpate herself, the guilty person may ascribe death to 'fits.' In one instance, an infant was timely saved by the mother having discovered, while the nurse was sleeping, a mass of wash-leather projecting from its mouth. The woman awoke, and attempted to remove and conceal the leather, but she was discovered in the act. The detection of this dangerous practice can only be a matter of accident; hence a fatal case can be rarely the subject of a coroner's inquest, and even then medical evidence may fail to throw any light upon the cause of death. In one instance only have we known it to give rise to a criminal charge. (*Reg.* v. *Cox*, Warwick Lent Ass., 1848.) The mother, a pauper, was tried for the attempt to suffocate her infant, eleven days old. The child was discovered by another person with a piece of rag hanging from its mouth. It was livid in the face, but when the rag was removed it made a violent gasp, and recovered its breath. There was no malice on the part of the prisoner, but it was made a strong point in her favour that instances had occurred in the workhouse, in which women had with impunity put rags with sugar into the mouths of infants in order to soothe and keep them quiet. She was acquitted. This admitted practice of infantile suffocation appears to have passed without reprimand or even comment, although this plan of soothing infants is just as likely to be fatal to them as that of encircling their necks with tight ligatures.

SMOTHERING.

Smothering is a variety of suffocation, and consists in the mere covering of the mouth and nostrils in any way so as to prevent the free ingress and egress of air. Like drowning, hanging, or strangulation, it produces death by asphyxia. In new-born infants it is not an unusual occurrence, sometimes originating in accident, and at others in criminal design. An infant may be speedily destroyed by smothering. If the mouth be only lightly covered with clothing, or slightly compressed, so that respiration is interrupted, as in the act of carrying a child in the arms, this will suffice to cause death; and, as it has been already remarked, death may take place without being preceded by convulsions or other striking symptoms. Smothering is not often resorted to as a means of perpetrating murder, except in infants or in debilitated and infirm adults. In a case which occurred at Ayr, a woman was charged with the murder of her child by smothering it in her shawl. She was travelling in a steamboat; it was a cold stormy day, and she had wrapped the shawl closely round the head of the child. There could be no doubt, from the moral circumstances, that she had intended to kill it; but the defence was that she had merely intended to protect the child from the cold, and it was suffocated before she was aware of it. There were no facts to exclude this defence, and the woman was acquitted. But children may be thus accidentally destroyed through the ignorance of persons who nurse them.

According to Wakley, infants are frequently found dead owing to their being suckled at night while the woman is in bed. The child's face is pressed on the breast; mother and child fall fast asleep; the head slips beneath the clothes, and the child is then quietly suffocated. There is no mark of pressure or violence on the body. ('Lancet,' 1858, i. p. 69.) This statement is strongly confirmed by the annual returns of the Registrar-General. A child (five days old) died quietly on its mother's arm while lying in bed. There was much lividity about the head, neck, and back; but there were no marks of violence. The bronchial tubes of the right lung contained bright florid blood. The left lung was gorged with blood, but none had escaped. The heart was firmly contracted, and there was only a small quantity of blood in its right cavities. According to the returns of the Registrar-General, suffocation in bed from 'overlaying' is a frequent cause of violent death among infants. Infants are readily smothered by the bed-clothes accidentally covering the mouth and nostrils, and they have not the power to change their position.

The *appearances* met with in the bodies of three children who had died under these circumstances are thus described by Canton. *Externally:* features placid; lips congested; eyes not unduly prominent; conjunctivæ rather reddened; hands clenched; no patches of ecchymosis found on the skin. *Internally:* head—patches of effused blood here and there beneath the pericranium; great congestion of the pia mater, accompanied by numerous effusions of blood, varying in size from a pin's point to a silver penny (*sic*) in superficial extent; a little clear fluid in the ventricles; some frothy mucus in the windpipe and bronchi, with redness of their lining membrane. The lungs were much congested and crepitant, whilst beneath the pleuræ, blood was effused, presenting numerous small bright-red patches and fine points (punctiform ecchymoses). The pericardium contained some serum, and was spotted in its whole extent in the manner described; the vasa vasorum of the heart's great vessels and thoracic aorta were minutely injected. The right cavities of the heart in all the cases contained dark liquid blood; the left cavities were nearly empty; the tissue of the organ was free from effused blood. The surface only of the thymus gland was mottled like the heart.

There is a prevalent notion that congestion of the lungs is an invariable accompaniment of death from suffocation, and where this was not found it has been hastily assumed that death had taken place from some other cause. Some remarks on this post-mortem appearance have been made in the chapter on Drowning; and it is desirable, in reference to future cases, to point out the fallacy involved in the assumption that congestion of the lungs is necessarily present in death from suffocation. Watson observes that the gorged state of the right side of the heart and lungs is greatest where the act of suffocation (asphyxia) has been slow and gradual, by the access of air to the lungs not having been completely prevented. When, on the other hand, death has taken place quickly or suddenly from this cause, there is little or no unusual congestion of blood in the lungs or heart. ('On Homicide,' p. 115.) At p. 118 he describes a case of death from suffocation in which the lungs were natural; and in the case of *Campbell*, for whose murder by suffocation *Burke* was convicted and executed in 1828–9, Christison and Newbigging found the organs within the chest perfectly natural, the lungs remarkably so, and unusually free from infiltration. The blood in the heart and great vessels, as well as throughout the body, was fluid and black. ('Edin. Med. and Surg. Jour.,' vol. xxxi. p. 239.) Again, in the case of *Carlo Ferrari*, for the murder of whom *Bishop* and *Williams* were convicted in London in 1831, the lungs were quite healthy, and not congested; the heart was rather small, contracted, and its four cavities were perfectly empty. The prisoners in this case confessed that they had destroyed the deceased by suffocation. From these facts it will be perceived that the actual state of the lungs and heart in the bodies of those who had been notoriously murdered by suffocation, is that which has been wrongly pronounced to be inconsistent with this mode of death.

Certain trials which took place many years since clearly proved that persons in a state of intoxication or infirmity had been murdered by smothering, for the sake of the money derived from the sale of the dead bodies. The victims were commonly destroyed by the assailant resting with his whole weight upon the chest, so as to prevent the motion of the ribs, and at the same time forcibly compressing the mouth and nostrils with his hands, to prevent the entrance of air. A case of this kind was referred to the author for examination in 1831. (*Rex* v. *Elizabeth Ross*, C. C. C., Dec. 1831.) It was remarkable for the fact that the prisoner was convicted of homicidal suffocation, although the body of the deceased was never discovered. ('Lond. Med. Gaz.,' vol. xxxvii. p. 481.) In *Reg.* v. *Norman*, C. C. C., July, 1871, the prisoner, a girl, æt. 15, was indicted for murder by suffocation. She was a nursery-maid, and had had the care of three children; the deceased, one of these children, being fifteen months old. There were three other charges of murder by suffocation against her, and one of an attempt to murder. There were suspicious marks of violence on the lower lip of the deceased, as if produced by pressure of the mouth against some hard substance. The medical witnesses attributed death to suffocation by pressure on the mouth, but admitted that the marks might have been accidental. On this admission the prisoner was acquitted. On the trial for the attempt to murder, the girl was convicted, and the evidence given in this case threw a light upon the mode in which she might have perpetrated the four murders with which she was charged. A little boy, æt. 10, was heard to give an alarm while in bed; it was a stifled cry. The prisoner was caught in the act of getting off the bed. The boy was in great agitation, and said that the prisoner had tried to strangle him while he was sleeping. He was awoke by feeling a hand on his mouth and throat. He tried to make a noise, upon which the prisoner, who was lying upon him, gave him a sweetmeat, and told him not to cry. His lips and throat were very sore. The prisoner was convicted and sentenced to ten years' penal servitude. There can be no doubt that the four murders were all perpetrated in a similar manner, by burking—the children being helpless, and unable to give an alarm. The conviction of the prisoner on the attempt simply arose from this child being older and better able to resist. The facts show that medical science in many of these cases is powerless to aid the law. It is not always possible to distinguish murder by smothering or suffocation from accident.

In reference to the case of *Campbell*, Christison observes 'that the conviction in the public mind, that a well-informed medical man should always be able to detect death by suffocation simply by an inspection of the body and without a knowledge of collateral circumstances, is erroneous, and may have the pernicious tendency of throwing inspectors off their guard, by leading them to expect strongly marked appearances in every case of death from suffocation. That such appearances are very far from being always present ought to be distinctly understood by every medical man who is required to inspect a body and give an opinion of the cause of death.' At the same time, in the absence of marked appearances to indicate violent death, due caution should be used by a medical witness in expressing an opinion. At the trial of the prisoner *Burke*, Christison restricted his opinion by stating that death by violence was, from the medical circumstances alone, *very probable*—a degree of caution which, on similar occasions, it will be desirable for a medical witness to imitate. It is not possible to carry medical evidence further than this. There is nothing in the act of suffocation, as there is in wounds, poisoning, hanging, or strangulation, by which the hand of a criminal can be clearly and unequivocally traced.

As an accident, smothering may be conceived to take place when a person falls, in a state of intoxication and debility, so that his mouth is in any way covered, or the access of air to the mouth or nostrils is interrupted. On an inspection of the body, the appearances elsewhere described will be met with in the lungs and heart. If the person has been able to struggle, it is probable that slight marks of violence in the shape of scratches or bruises may be found about the mouth and nostrils, with bruises or marks of pressure on the chest, legs, or arms, and redness of the mucous membrane, with a bloody mucous froth as well as foreign substances in the air-passages. The marks of violence may be slight, or even entirely absent. In a case of suspected murder, a medical jurist should look for the special indications of suffocation in the lungs, the circumstances under which the body or bodies are found, the evidence of sudden death in the presence of food in the stomach, and lastly the absence of any other cause to account for death. All these sources of evidence may fail; and as the means by which homicidal smothering was accomplished are not likely to be found with the body, a medical opinion on the case may become little more than a conjecture. Still, this may suffice when the evidence from extraneous circumstances is strong.

CHAPTER 42.

GASEOUS POISONS. — CARBONIC ACID.—SYMPTOMS. — APPEARANCES. — ANALYSIS.—EFFECTS OF CHARCOAL-VAPOUR.—CARBONIC OXIDE.—COAL AND COKE VAPOUR.—SULPHUROUS ACID.—VAPOURS OF LIME, CEMENT, AND BRICK-KILNS.—CONFINED AIR.—COAL-GAS.—CARBURETTED HYDROGEN.—NITROUS OXIDE.—SULPHURETTED HYDROGEN.—EFFLUVIA OF DRAINS AND SEWERS.

Mode of Action of Gaseous Poisons.—In following common language, a medical jurist is compelled to apply the term 'suffocation' to another variety of death—viz. to that of poisoning by *gases*. Physiological accuracy must here be sacrificed, in order that we may make ourselves generally intelligible. Thus, if a person die from the effects of carbonic acid, of confined air, of sulphuretted hydrogen, or of other noxious gases, he is commonly said to die suffocated. Strictly speaking, he dies poisoned—as much so as if he had taken oxalic or hydrocyanic acid. The only differences are: (1) that the poison, instead of being liquid or solid, is *gaseous;* and (2) instead of being applied to the mucous membrane of the stomach, it affects that of the *air-cells* of the lungs. In the action of arsenetted hydrogen we have a clear instance of poisoning by a gas, and in the respiration of the narcotic vapours of chloroform and ether we have also illustrations of this form of poisoning. Owing to the fact that the poisonous material is in a finely divided state of vapour, and that in the air-cells of the lungs it meets at once with a large absorbing surface and instantly enters the blood, the effects are more rapid and more strongly marked. It has been observed, too, that some (and probably all) of these aerial poisons have an accumulative action—*i.e.* their effects continue to increase for a short period, even after a person has ceased to breathe them.

The remarks made respecting the action of gases on the lungs apply equally to the effects produced by the *vapours* of alcohol, ether, chloroform, and bichloride of methylene. The specific action of some of these vapours has been elsewhere noticed (*ante*, p. 182). A person dies not only from the privation of oxygen, but from the absorption of the poisonous vapour into the blood through the pulmonary membrane. Although often described as cases of suffocation, they are not to be regarded as such. Hydrogen and nitrogen have been considered to be the only two gases which operate as negative agents, *i.e.* by simply excluding oxygen; but hydrogen breathed with oxygen in atmospheric proportions has been found to produce narcotism.

Norris has endeavoured to determine experimentally the relative periods of time within which some of these vapours and gases may prove fatal. He employed a chamber filled with common air in which a rat could live without inconvenience for a period of three hours. When pure hydrogen was substituted for air, the animal lived for nine minutes. This was taken to represent death from the privation of air or oxygen, and assuming this as a standard, the following table shows the time in which death occurred with different gases and vapours:—

	Min.	Sec.
Pure hydrogen gas in	9	0
Common air saturated with ether	5	0
„ „ with chloroform . . .	1	30
„ „ with bichloride of methylene .	0	20
Pure nitrous oxide gas	0	25
Oxygen gas saturated with ether	8	30
„ „ with chloroform . . .	0	25
„ „ with bichloride of methylene .	1	45
Pure carbonic acid gas	0	8

(See 'Brit. Med. Jour.,' 1873, ii. p. 401.) In the experiments on dogs performed by the Committee of the Med.-Chir. Society, it was found that, under complete privation of air, the heart's action continued for a period of eight minutes and twenty seconds. This very nearly corresponds to the time at which life ceases in pure hydrogen. These results show that the gases and vapours are directly poisonous agents, and that they do not produce their effects merely by excluding oxygen or air.

The Cause of Death mistaken.—The greater number of the poisonous gases are chiefly complex products of art, and are never likely to be met with in the atmosphere so abundantly as to produce injurious consequences; hence fatal accidents arising from their inhalation most commonly occur under circumstances which can leave no doubt respecting the real cause of death. The peculiar effects of all of these it will not be necessary to describe in this place; but there are two, a knowledge of the properties and operation of which may, on certain occasions, be required of a medical jurist; these are the CARBONIC ACID and SULPHURETTED HYDROGEN GASES. Agents of this description can rarely be employed with any certainty as instruments of murder; and, if they were so employed, the fact could be established only by circumstantial evidence. One alleged instance of murder by carbonic acid is, however, reported by Devergie. ('Ann. d'Hyg.,' 1837, t. 1, p. 201.) Death, when arising from the breathing of any of the gases, is generally attributable to suicide or accident. In France it is by no means uncommon for a person to commit self-destruction by sleeping in a closed apartment in which charcoal has been suffered to burn; while in England accidental deaths are sometimes heard of where coal or coke has been employed as fuel in small and ill-ventilated rooms. On such occasions, a person may be found dead without any apparent cause to the casual observer. The face may appear pale or livid, and the skin may be covered with patches of lividity. The discovery of a body under these circumstances may be sufficient, in the eyes of the vulgar, to create a suspicion of murder; and some person with whom the deceased may have been at that period on bad terms will perhaps be pointed out as the murderer. In such a case, it is obvious that the establishment of the innocence of the accused will depend entirely on the discrimination and judgment of a medical practitioner. An instance, illustrative of the consequences of this popular prejudice, occurred in London in 1823. Six persons were lodging in the same apartment, where they were all in the habit of sleeping. One morning an alarm was given by one of them, a woman, who stated that, on rising, she found her companions dead. Four were discovered to be really dead, but the fifth, a married man, whose wife was one of the victims, was recovering. He was known to have been on intimate terms with the woman who gave the alarm, and it was supposed that these two had conspired to destroy the whole party, in order to get rid of the wife. The woman who was accused of the crime was imprisoned, and an account of the supposed barbarous murder was soon printed and circulated in the metropolis. Many articles of food about the house were analysed in order to discover whether they contained poison, when all the circumstances were explained by the man stating that he had placed a pan of burning coals between the two beds before going to sleep, and that the doors and windows of the apartment were kept closed. (Christison, p. 583.) Cases of a similar kind, in which there was at first a strong suspicion of poisoning, have been reported. ('Lond. Med. Gaz.,' vol. xxxvi. p. 937; 'Ann. d'Hyg.,' 1843, t. 2, p. 56; 'Med. Chron.,' vol. ii. pp. 80, 84.)

CARBONIC ACID.

This gas is freely liberated in respiration, combustion, and fermentation; it is also produced in the calcination of chalk or limestone, and is sometimes diffused through the shafts and galleries of coal-mines, where it is commonly called 'choke-damp.' Carbonic acid gas is likewise met with in wells, cellars, and other excavations in the earth. In these cases it is generally found most abundantly on the soil, or at the lower part of the well; and it appears to proceed from the decomposition of animal and vegetable matters confined in such situations. The slow evaporation of water strongly charged with the gas, while trickling over the sides of these excavations, may likewise assist in contaminating the air. Damp sawdust, straw, or decayed leaves slowly absorb oxygen from a confined atmosphere, and set free carbonic acid.

Davy believed that carbonic acid, in a perfectly pure state, did not pass into the windpipe when an attempt was made to breathe it; the glottis seemed to close spasmodically at the moment that the gas came in contact with it. On diluting the carbonic acid with about twice its volume of air, he found that he could breathe it; but it soon produced symptoms of giddiness and somnolency. In a diluted state there is no doubt that it penetrates into the lungs, and that it is absorbed and circulated with the blood. In estimating the effects of this gas when mixed with air, a distinction must be made. The gas may either be simply added to the air or it may be produced at the expense of the oxygen in the enclosed space or apartment. In the latter case, it must be remembered that every volume of carbonic acid thus produced represents an equal volume of oxygen removed. Such an atmosphere is, therefore, more destructive than another in which the air and gas are in simple admixture. If we assume that in each case the noxious atmosphere contains 10 per cent. of carbonic acid, then in one instance there will be 8 per cent. more of oxygen and 8 per cent. less of nitrogen than in the other, since the production of 10 parts of carbonic acid as a result of combustion implies the loss of 10 parts of oxygen. This difference in the proportions may not be, practically speaking, correct, because there is no apartment sufficiently closed to prevent air rushing in from the exterior while combustion is going on within it; but, nevertheless, the above statement may be taken as an approximation to the truth. The air in small apartments is rapidly vitiated by combustion, especially when the room is not properly ventilated by the door, window, or fireplace. In 1874, a man and his wife were found dead in their bedroom at Bristol, in the attitude of making their escape. A paraffin-lamp was still burning on the table. The noxious vapour from this lamp, in a small, ill-ventilated room, had sufficed to cause death.

The statements made by chemists and physiologists, respecting the proportion of carbonic acid in air required to produce noxious or fatal effects on human beings, are very conflicting. Small animals, such as birds and mice, have been generally made the subjects of experiment, but the results thus obtained cannot be satisfactorily applied to show the relative action of carbonic acid on man. Berzelius stated that a proportion of 5 per cent. in air was not injurious, and that such a mixture might be usefully employed in the treatment of consumption. Allen and Pepys inferred, from their experiments on guinea-pigs, that 10 per cent. of the gas would prove fatal to man. In the more recent experiments of Bernard, this inference is corroborated by the fact that a bird died in two hours and a half in an atmosphere consisting (in 100 parts) of 9·5 of carbonic acid, 28 of oxygen, and 62·5 of nitrogen. ('Les Sub. Toxiques,' 1857, p. 135.) In this case the proportion was less than 10 per cent., while the proportion of oxygen was 7 per cent. more than that existing in the atmosphere. On the other hand, Demarquay says that one part of carbonic acid (25 per cent.) and three parts of air produced in man but slight discomfort after being breathed for some time. According to this writer, most of the accidents caused by charcoal-vapour, confined air, and gases in fermenting vats, are wrongly ascribed to carbonic acid, and should be attributed to carbonic oxide, sulphuretted hydrogen, alcoholic vapours, or other gases not yet understood. ('Chem. News,' Aug. 4, 1865.) Those who have employed mixtures of carbonic acid and air for anæsthetic purposes have stated that air containing 20 per cent. of carbonic acid may be breathed without any injurious effects. Such a mixture would be composed (in 100 parts) of 20 of carbonic acid, 16 of oxygen, and 64 of nitrogen. In this mixture, if carefully made, oxy-combustion cannot be maintained; hence, if there was no error in the above proportions, it follows that a man can breathe with safety and live in air in which a candle will not burn. Bernard's carefully performed experiments are adverse to these statements. He found that animals died in atmospheres in which the proportion of carbonic acid varied from 12 to 18 per cent., while the amount of oxygen varied from 5 to 30 per cent. ('Les Sub. Toxiques,' p. 140.) When it is asserted that a person can thus breathe with impunity proportions which are fatal to life, it would be desirable to know how such mixtures were made, and whether proper care had been taken to prevent the breathing of air by the mouth and nostrils, while the supposed poisonous mixture was being inhaled. Lives are sometimes successively lost in wells charged with carbonic acid, and in brewers' vats, in consequence of one person after another, in the foolish expectation of at least being able to attach a rope to the body of an asphyxiated person. The moment that the mouth comes within the level of the invisible dense stratum of gas, muscular power is lost, and the person commonly sinks lifeless.

Symptoms.—The symptoms of poisoning by carbonic acid vary according to the proportion contained in the air which is breathed. In a concentrated state there is sudden insensibility, followed by death, unless the person is immediately removed into pure air. When the air is gradually poisoned so as to acquire its lowest poisonous proportion, insensibility comes on more slowly; and, as in ordinary narcotic poisoning, it is preceded by giddiness, somnolency, and loss of muscular power. When the gas is in a fatal proportion, the symptoms commonly observed are as follows: A sensation of great weight in the head, a sense of pressure in the temples, singing in the ears, a pungent sensation in the nose; a strong tendency to sleep, accompanied by giddiness, and so great a loss of muscular power that, if the person be at the time in an erect posture, he instantly falls to the ground as if struck. The breathing, which is observed to be at first difficult and stertorous (snoring), becomes suspended. The action of the heart, which on the first accession of the symptoms is very violent, soon ceases; sensibility is lost, and the person now falls into a profound coma, or state of apparent death. The warmth of the body still continues; the limbs are relaxed and flexible, but they have been observed in some instances to become rigid, or even occasionally convulsed. The countenance is livid or of a leaden colour, especially about the eyelids and lips, but on some occasions it has been pale and placid. The access of these symptoms is stated to have been sometimes accompanied by a pleasing sensation of delirium, while at others the most acute pains have been suffered. In some instances there appears to have been irritability of the stomach, for the affected person has vomited the contents of his stomach in a semi-digested state. Those who have been resuscitated have felt pain in the head, or pain and soreness over the body for several days; while, in a few severe cases, paralysis of the muscles of the face has supervened on recovery.

An old woman occupied a room under one in which there was a quantity of nitric acid kept in store. Owing to some accident, a carboy was broken; the acid ran through the ceiling into the room below, acting upon and corroding the bed-coverings of the deceased's bed. As the room was quite filled with the nitric acid fumes, a chemist was consulted, and he advised that whiting should be freely used for the purpose of neutralizing the acid. This advice was followed, and several persons, who were in the room witnessing the operation, felt oppressed and were obliged to leave it; they were observed to stagger as if intoxicated, on reaching the street. The room was then completely closed, and the whiting allowed to remain in contact with the acid. The deceased had suffered from diarrhœa for a few days previously, and was obliged to resort to the night-chair, which was in the room in which the accident had occurred. As she remained absent half an hour, some persons entered the apartment, and found her in a chair unable to move. She was taken into another room, and on a medical man being called to her, he found her sleepy and comatose and her mind confused; there was great difficulty of breathing, extreme lividity of the face and lips; the arms and legs were cold, and the pulse was full. In spite of efforts made to save her, she died in about an hour from the time at which she had entered the room. Those who found her in the apartment do not appear to have suffered. This was a case of slow poisoning by carbonic acid, for no carbonic oxide could have been evolved from the action of the acid on chalk. Age and debility from previous illness may account for the unusual circumstances that the deceased did not recover on being removed to a pure atmosphere.

Post-mortem Appearances.—In some instances the face has been found livid and swollen and the features distorted; but more generally it has been pale and placid, as if the person had died without a struggle in the position in which his body was found. The skin is sometimes livid, or presents patches of lividity, and the limbs are quite flaccid. The pupils have been found dilated. Internally, the venous system is filled with liquid blood of a dark colour. In death from carbonic acid as a result of combustion, the blood has sometimes had a light-red colour. The vessels of the lungs and brain are observed to be especially in a state of congestion. The tongue appears swollen, and sometimes the mucous membrane of the intestinal canal presents dark ecchymosed patches. The following appearances were met with thirty hours after death in the bodies of two adults, male and female, who died from the accidental introduction of carbonic acid into their bedroom from burning ashes. Externally, there was nothing unnatural, excepting a few slight discolorations on the back of the man; internally, there was congestion of the membranes and great vessels of the brain. Each lateral ventricle contained about half an ounce of clear serum; the lungs were gorged with dark blood; and the lining membrane of the air-tubes (bronchi) was slightly reddened. The left sides of the heart were nearly empty; the right contained a quantity of dark half-coagulated blood. The stomachs were healthy. The bodies were found on the floor of the bedroom in easy positions. The deceased persons had had the power to get out of bed, but were unable to escape from the chamber. It will be perceived from this description that there is nothing very characteristic in the appearances, and thus it is always easy to ascribe death to apoplexy or some other cause; but it should be remembered that carbonic acid itself is a narcotic poison, inducing cerebral congestion and apoplexy.

Analysis.—Sometimes a medical jurist may be required to state the nature of the gaseous mixture in which a person may have died. There will be no difficulty in determining whether carbonic acid is or is not the deleterious agent in such a mixture. When it exists in a confined atmosphere, its presence may be identified, if previously collected in a proper vessel, by the following characters:—1. It extinguishes a taper if the proportion be above 12 or 15 per cent. 2. Lime-water or baryta-water is instantly precipitated white when poured into a jar of the gas; and the precipitate thus formed may be collected by filtration, and proved to possess the well-known properties of carbonate of calcium or barium. Air containing only one per cent. of carbonic acid affects lime-water; if it amounts to two per cent., a few cubic inches will suffice to show its presence by the lime-water test. The *proportion* in which carbonic acid exists in a mixture may be determined by introducing into a measured quantity, in a graduated tube over mercury, a strong solution of potash. Absorption will take place after a certain time, and the degree of absorption will indicate the proportion of carbonic acid present. Carbonic acid in a well may be collected for the purpose of testing, by lowering a bottle filled with fine sand, by means of a string attached to the neck, and guiding the bottle by another string attached to its base. When the bottle is within the stratum, it should be turned with its mouth downwards; and when the sand has fallen out, the bottle may be rapidly raised, with its mouth upwards, by pulling the string attached to the neck. It should be immediately corked and the contents examined.

Combustion in Mixtures containing Carbonic Acid.—In reference to suffocation by carbonic acid, there is one circumstance which requires attention. It is a matter of popular belief—and, in fact, it is asserted by some writers on asphyxia—that the burning of a candle in a suspected mixture of carbonic acid and air, is a satisfactory proof that it may be breathed with safety. The results of some experiments on this subject led the author to the conclusion that a candle will burn in air which is combined with even 10 or 12 per cent. of its volume of carbonic acid gas; and although such mixtures might not prove immediately fatal to man, yet they would soon give rise to giddiness, insensibility, and ultimately death, in those who, after having been once immersed in them, did not hasten to quit the spot. In air containing a smaller proportion than this (5 or 6 per cent.), a candle will readily burn, but it is probable that such a mixture could not be long respired without causing serious symptoms; hence the *burning of a candle can be no criterion of safety* against the effect of carbonic acid. It is true that it would not be safe to venture into a gaseous mixture in which a candle is extinguished; but the converse of this proposition is not true—namely, that a mixture in which a candle burns may be always breathed with safety. It has been observed on several occasions that the combustion of charcoal has been maintained in a room in which persons have been found in a state of insensibility from breathing the vapours.

Diffusion of Carbonic Acid.—Some important medico-legal questions have arisen, relative to the diffusion of this gas in air, when produced by combustion. It was formerly supposed that, owing to its great density (1·52), it would collect on the floor of an apartment, would gradually rise upwards and suffocate persons at different times, according to the level on which they might happen to be placed. Questions on this subject have been variously answered, and a great difference of opinion has arisen among witnesses. There are two important points on which a correct answer to this inquiry must be based: first, the law of the diffusion of gases; and second, the effect of heat in greatly diminishing the specific gravity of a gas naturally heavier than air. There is no doubt that, in a narrow or confined vessel, exposed to air, carbonic acid is slow in escaping; nevertheless, it mixes with air, and passes off rapidly in proportion to the surface exposed. In the course of an hour or two, in spite of its great specific gravity, none will be contained within the vessel. The well-known Grotta del Cane at Pozzuoli, near Naples, has been referred to by those who hold that carbonic acid always tends to remain on the lowest level; but it has been forgotten that, in this and similar excavations, carbonic acid is continually issuing from crevices in the soil, so that that which is lost by diffusion is continually replaced: hence the illustration proves nothing. It may suffice to state that air and carbonic acid mix readily on contact in all proportions, although they enter into no chemical union. Thus then, at common temperatures, carbonic acid has no tendency to remain on the floor or soil, when there is a free access of air or contact with other gases. The combustion diminishes the specific gravity of the gas, and the carbonic acid therefore ascends with the heated current of air, and diffuses itself in the upper part of an apartment, when there are no means of carrying it off.

CHARCOAL-VAPOUR.

The vapour given off during the combustion of charcoal is not pure carbonic acid, but a mixture of gases. It operates fatally when breathed, partly in consequence of the carbonic acid contained in it, and partly from the presence of a variable proportion of carbonic oxide. The proportions of these gases, however, are subject to variation, according to whether the combustion is vivid or not. When the charcoal was burning vividly, the quantity of carbonic acid was found by Orfila to be less than when it was either nearly extinguished or beginning to burn. In the former case the carbonic acid was in the proportion of about 11 per cent. by volume, in the latter the proportion amounted to about 14 per cent. Leblanc found that charcoal burning in the open air produced about one-half per cent. of carbonic oxide. There is no doubt that a low or imperfect combustion is more favourable to the production of this gas, and it is considered to operate more powerfully on the body than carbonic acid. According to Leblanc, a bird was killed instantly by breathing air containing 4 or 5 per cent. of carbonic oxide; 1 per cent. only sufficed to cause death in two minutes. Charcoal-vapour may be regarded as a mixture of carbonic acid, carbonic oxide, aqueous vapour, and air partially deoxidized. The fatal effects produced by the vapour are owing to the action of carbonic acid and carbonic oxide, and, according to Bernard, a mixture of the two is more destructive than either gas separately. ('Les Sub. Toxiques,' p. 212.) Leblanc endeavoured to determine the proportion of the gases in charcoal-vapour when this was in such a condition as to prove fatal to animal life. The vapour was conducted from some fully ignited fuel into an enclosed space in which there was a middle-sized dog whose condition could be watched. In ten minutes the animal fell exhausted, and in twenty minutes it died, after some hard breathing. A candle burnt with its usual brightness in the closed room, and it was only ten minutes after the death of the dog, that the flame of the candle, from becoming paler and paler, was extinguished. The air of the chamber was at this time collected and analyzed; it contained, in 100 parts—carbonic acid, 4·61; carbonic oxide, 0·54; carburetted hydrogen, 0·04; oxygen, 19·19; and nitrogen, 75·62. It would thus appear that less than 5 per cent. of carbonic acid is fatal to life when so little as one-half per cent. of carbonic oxide is mixed with it. (Bernard, op. cit., p. 159.) The burning of a candle under the circumstances will also show that oxy-combustion may be maintained in a mixture by which an animal is killed, and therefore that combustion can furnish no criterion of safety in apartments in which charcoal has been burnt. Biefel and Poleck have shown that charcoal-fumes contain on an average carbonic acid and carbonic oxide in the relative proportions of one to twenty; and that carbonic oxide is the chief poisonous agent. ('Zeitschr. für Biologie,' Bd. xvi. p. 279.)

Symptoms and Appearances after Death.—The following case, illustrating the effects of charcoal-vapour, occurred to Collambell. ('Lond. Med. Gaz.,' vol. xxvii. p. 693.) A man was engaged to clean the windows of three small rooms on the basement-floor of a house. The first room had a door opening into a courtyard; the others merely communicated with each other by a central door, and there was no fireplace in any one of them. A brazier of burning charcoal had been placed in the outer room for the purpose of drying it, but it appeared that the deceased had shut the outer door, and had removed the brazier into the inner room of the three, leaving the communicating doors open. In *two hours* the man was found quite dead, lying on the floor of the middle room. The countenance was pale, as well as the whole of the skin; the eyes were bright and staring, the pupils widely dilated, the lips bloodless, the jaws firmly fixed, the tongue protruding; and the face and the limbs were cold. Some frothy mucus had escaped from the mouth. The person who discovered the deceased found the ashes in the brazier still burning, and he experienced great oppression in breathing. An inquest was held, but without an inspection of the body, and a verdict of 'accidental death' returned. The body was afterwards privately inspected by Collambell. On opening the head the vessels on the surface of the brain were found much distended with dark liquid blood; the pia mater was bedewed with serum. The brain was of unusually firm consistency, and numerous bloody points appeared on making a section of it. The lateral ventricles were distended with about an ounce and a half of pale serum, and the vessels of the choroid plexus were much congested. The cerebellum was firm, and presented on section numerous bloody points. About two ounces of serum, tinged with blood, were collected from the base of the skull. The lungs had a slate colour. On the left side of the chest there were eight ounces of serum tinged with blood, and nearly an equal quantity on the right side. On cutting into the organs, a large quantity of serous fluid mixed with blood, escaped. The bronchial tubes were filled with a frothy fluid tinged with blood. The pericardium contained an ounce of pale serum; the heart was enlarged,—its cavities contained no blood; the liver and kidneys were, however, much gorged. There was no doubt that the cause of death was the inhalation of charcoal-vapour; and it is probable that the man died from respiring but a comparatively small proportion. The capacity of the chambers must have reached nearly two thousand cubic feet; the deceased had been there only two hours, and when the person who discovered him entered the rooms, the air was not so vitiated but that he could breathe, although with some oppression. The fuel was then in a state of combustion.

In a case of death from charcoal-vapour that was referred to the author for examination in 1851, there was a considerable effusion of blood in the submucous tissue of the stomach. This appearance led to a strong suspicion of irritant poisoning. A full investigation of the circumstances, however, showed that the suspicion was unfounded. The vapour had descended through a flue communicating with the bedroom in which the deceased slept with her husband; it destroyed the wife, and nearly killed the husband. A stove with burning charcoal had been placed in the room above that in which the couple slept, and an iron pipe conveyed the products of combustion into a flue, whence they had descended into the bedroom, and caused the fatal accident. It is sometimes difficult to account for the mode by which these gaseous mixtures find their way into an apartment. In the above-mentioned case we had great difficulty in procuring correct information. There was no fire in the bedroom, or any source of combustion, and this at first strengthened the suspicion that the husband must have poisoned the wife at their supper on the previous night. Devergie relates a somewhat similar case, in which the wife was found dead in bed, while the husband, lying by her side, was in a state of unconsciousness, from which he did not recover until the next day. In this case there was neither stove nor fire, nor any source of combustion in the room. The noxious gases must have leaked into the room through fissures in a chimney adjoining it. ('Ann. d'Hyg.,' 1871, t. 2, p. 441.) A mother and daughter went to bed. In the morning, the daughter was found on her face, dead—the face livid, and there had been copious bleeding from the nose. The mother was insensible, and recovered only after many hours under treatment. The cause of the accident was traced to an imperfect joint in a furnace-flue, which passed through the bedroom to a chimney. This adjoined their bed, and the leakage took place directly upon them. The door was shut, and the smell, perceived at first, was supposed to come in from the outside. ('Lond. Med. Gaz.,' vol. xlvii. p. 412.) In the case of a youth, æt. 17, Guérard found the mouth and nostrils filled with froth. The liver and spleen were gorged with dark liquid blood; the heart was collapsed and its cavities were empty, but liquid and dark-coloured blood flowed from the large vessels. The windpipe and bronchi had a red colour, and were filled with frothy mucus. The membranes of the brain were congested, and the sinuses gorged with fluid blood. The face was pale, the eyelids were closed, and the pupils natural. There were livid patches over the body. ('Ann. d'Hyg.,' 1843, t. 2, p. 57.)

It often excites surprise on these occasions that no exertion has been made to escape, when it would apparently require but slight efforts on the part of the person affected. The action of this vapour is very insidious: one of its first effects is to create an utter prostration of strength, so that even on a person awake and active, the gas may speedily produce a perfect inability to move or to call for assistance. (For a case illustrative of the dangerous effects of the diluted vapour, see 'Edin. Med. and Surg. Jour.,' vol. i. p. 541.) In this instance a charcoal-brazier was left, only for a short time, in the cell of a prison. It was removed, and the prisoners went to sleep. They experienced no particular effects at first, but after some hours two were found dead. Thus, then, an atmosphere which can be breathed for a short time with impunity may ultimately destroy life. Leudet has shown that in some persons the first effect of the inhalation of charcoal-fumes is to induce a state of unconsciousness. ('Jour. de Méd.,' Oct. 1883, p. 472.)

Devergie first showed that the smothered combustion of *wood* may lead to the evolution of carbonic oxide, and give rise to dangerous consequences. ('Ann. d'Hyg.,' 1835, t. 1, p. 442.) His remarks have been confirmed by two cases published by Bayard and Tardieu. A man and his wife were found dead in bed. There was a smoky vapour in the apartment, but no fire had been lighted in the grate, and the chimney was blocked up. The planks of the floor were widely separated, and there was a large hole in the boards at the foot of the bed communicating with the apartment below. It was found, on examination, that some joists, connected with the flue of an iron plate which had been heated for making confectionery the previous day, were in a smouldering state; that the vapour had entered the bedroom of the deceased through the crevices in the floor, and, not finding a vent by the chimney, had led to these fatal results. It is remarkable that the source of combustion was nearly nine yards distant, and one person who slept nearer to the flue of the iron plate entirely escaped. In the body of the husband the skin was of a reddish tint, the blood liquid, the cavities of the heart empty, the lungs gorged, and there was no subpleural ecchymosis. In the body of the wife there was less redness of the skin, the blood was coagulated in the cavities of the heart, principally on the right side extending to the vessels; less engorgement of the lungs, and a great number of subpleural ecchymoses, indicating that strong efforts had been made to respire. There was at first a rumour of poisoning, which was only removed by a close examination of the locality. ('Ann. d'Hyg.,' 1845, t. 1, p. 369.)

Schauenburg has published the cases of two children who were destroyed in an hour by the vapour of burning wood. The mother had accidentally shut them up in a room, into which the vapour leaked from the wood employed to heat an oven. In each case the brain and its membranes were found highly congested, while the lungs were collapsed, and contained no more blood than is usually found in them. ('Vierteljahrsschr. für Gerichtl. Med.,' 1872, 1, p. 40.) It may be observed, in reference to this vapour, that when produced from burning charcoal or wood—in spite of the great density of carbonic acid, the noxious gas is diffused rapidly throughout the whole of an apartment. This is owing partly to the effect of the heated current of air, and partly to the diffusion of gases, whereby heavy and light gases are soon uniformly intermixed.

Bugnion and De la Harpe relate the following case. The latter was called at one p.m. to see a child which had just died. On his arrival, he found the dead body of a healthy-looking boy, aged five years, lying with dilated pupils on a bed in the natural attitude of sleep. The body was still warm; rigor mortis had invaded the arms; and there was some opacity of the cornea. On the under surface of the limbs, and on that side of the face on which the head rested, there were patches of cadaveric lividity. The mother did not know when death had taken place, having supposed the child to be asleep when she went to her work in the morning. By the side of the dead body of the child lay the father, who was unable to answer questions distinctly, laughed at whatever was said to him, and could give no information as to the death of his son. His face was suffused; there was foam on his lips; his breathing was very difficult; and his pulse was full and rapid. On another bed in the same room lay a boy of ten, pale, motionless, with cold clammy skin, thready pulse, and, in short, in a state of collapse. He recovered, and was out of danger in the evening. The mother, who slept in the same room, had, at first, felt scarcely any ill effects. In the course of the morning she felt unwell, and returned home from her work. The illnesses and the death were traced to the use of a charcoal-stove in use in the room where all slept. The condition of the father agrees with a case referred to by Casper, in which temporary mania was induced by charcoal-vapours; and with a case to be presently reported. In the case of the boy, Bugnion and De la

Harpe found the following appearances forty-eight hours after death: The tip of the tongue lay between the teeth; the inner surface of the lips was bright red, and parchmented; the rosy colour of the lungs was very noticeable, and these organs were gorged with blood, forming a striking contrast to the pale anæmic intestines. Only two small subpleural ecchymoses were found. The surface of the lung was unevened and bosselated, the depressed portions being of a deep violet hue, and containing a smaller quantity of air than the raised portions, which were rosy-red and emphysematous. On section, the tissue of the lung was found decidedly hyperæmic and of a scarlet colour. The whole of the mucous membrane from the epiglottis to the small bronchi was of a uniform vermilion tint. On pressure, thick mucus, untinged with blood, exuded from the bronchi. The heart was pale and soft. The blood throughout the body was fluid, and of a brighter colour than usual. No petechiæ were found in the organs, except the left kidney. The brain was deeply congested. The autopsy is thus summarized: intense general bronchitis; pulmonary congestion, with partial atelectasis; hyperæmia of the upper portion of the body, with anæmia of the abdominal viscera; fluidity and universal bright colour of the blood. ('Med. Chron.,' vol. ii. p. 84.)

Vapour of Gunpowder.—The vapour of exploded gunpowder is chiefly a mixture of nitrogen with carbonic acid, cyanogen compounds, and the vapour of sulphide of potassium. When fired in a close place where there is no ventilation, gunpowder expels the air containing oxygen, and substitutes for it a mixture of gases not fitted to support life. The effects of such a mixture when breathed may be gathered from the following cases, communicated in 1873 by Smith, of Shepton Mallet. A boy, æt. 14, went down a well immediately after a considerable charge of powder had been exploded in it. He dropped suddenly to the bottom of the well, and a man who followed him also dropped apparently lifeless. They were both drawn up as soon as possible. The man appeared stupefied, but speedily recovered. The boy was quite unconscious, was blue about the lips, almost pulseless, had epileptic convulsions, and appeared to be dying. He vomited much biliary and mucous fluid, and became worse after removal from the open air to the hospital ward. His breathing was loud, but air entered the lungs freely. The pupils were natural. He did not recover until after thirty-six hours. Artificial respiration was used and warm water baths were applied to the feet.

CARBONIC OXIDE.

The noxious effects of the vapour of burning charcoal are considered to be partly due to the presence of carbonic oxide, which appears to be chiefly extricated under a low or smouldering combustion of any kind of woody fibre. It is fatal to man and all animals. The action of this gas upon animal life has been made a subject of experiment by Bernard. ('Leçons sur les Sub. Toxiques,' p. 164.) An atmosphere containing from 5 to 6 per cent. of it will destroy life. The blood and muscles are brightened in colour by this gas, while they are darkened by carbonic acid. Bernard has observed that this bright colour has been retained for three weeks ; and he considers the mode of action of this gaseous poison such that it prevents the arterial blood of the body from becoming venous, while carbonic acid operates by preventing the venous blood from becoming arterial. (Op. cit., pp. 182, 195.) Carbonic oxide kills by combining with the red pigment of the blood, and rendering it insusceptible of taking up oxygen, and exchanging this in the tissues for effete carbonic acid.

This condition of the blood, as a result of the action of carbonic oxide, may occasion some doubt of the cause of death in cases of suffocation by fire. In 1858, an inquiry took place into the cause of death of fourteen persons, owing to a fire in a house at Bloomsbury. The medical witness, on examining the bodies, found a redness of the muscles and a redness of the blood. He therefore thought that death was not caused by suffocation, but from the inhalation of arsenical vapours, owing to some minerals containing arsenic having been partially consumed during the fire. But there was a total want of evidence to show that the vapours of arsenic, when breathed, would cause death so speedily as the noxious gases evolved by fire, or that they would redden the blood and muscles. On the other hand, the respiration of carbonic oxide would explain these facts. It is worthy of remark that, in many of the observed cases of death from charcoal-vapour, the blood has had a darker colour than natural: the greater solubility of carbonic acid, and the larger proportion in which it is produced, may account for this effect.

The action of carbonic oxide on the body is that of a narcotic poison. Tourdes has ascertained that rabbits died in twenty-three minutes, when kept in an atmosphere containing 1-15th of its volume of pure carbonic oxide; when the proportion was 1-30th they died in thirty-seven minutes, and when 1-8th in seven minutes. Letheby states that in his experiments a mixture of one-half per cent. killed small birds in three minutes, and of 1½ per cent. in about half this time. The animals showed no sign of pain: they fell in a state of insensibility, and either died at once without convulsions, or they gradually passed into a state of profound coma. He found, on inspection, that the blood was redder than usual, that the muscles of the heart were somewhat gorged, and that the brain was congested. ('Lancet,' 1862, i. p. 219.) Hoppe-Seyler states that animals which had been made to breathe carbonic oxide were restored by artificial respiration continued for some time, and, under these circumstances, the gas was expired as carbonic acid, having undergone further oxidation in the blood. It may be detected in the blood by the spectroscope. According to some observations, carbonic oxide is eliminated from the lungs as such without being converted into carbonic acid. ('Lancet,' 1873, i. p. 741.)

It is a remarkable fact that with the bright-red colour of the blood seen in this form of poisoning, two absorption-bands similar to those of oxy-hæmoglobin appear, and nearly in the same situation. They are, however, further from the line D, and are more in the greenish-yellow rays. A reducing agent (alkaline sulphide) does not affect these bands, as it does those of oxidized blood. Hence, if the person breathes for only a short time, the carbonic oxide is expelled. In poisoning by coal-gas, carbonic oxide appears to be sometimes the cause of death. It is always a constituent of this gas, but in variable proportion (see p. 477).

COAL AND COKE VAPOURS. SULPHUROUS ACID.

Products from Burning Coal and Coke.—The gases extricated in the smothered combustion of coal or coke, in addition to carbonic acid, contain carbonic oxide, and tarry vapours. We may expect to find in the atmosphere of a close room in which such a combustion has been going on, SULPHUROUS ACID GAS; and from coal, in addition to this, sulphuretted and carburetted hydrogen gases. These emanations are fatal to life; but in consequence of their very irritating properties, they give warning of their presence, and are therefore less liable to occasion fatal accidents. From an accident which occurred at Colchester a few years since, in which two children lost their lives, it would appear that some persons are so ignorant as to believe that the vapour of coke is less fatal than the vapour of charcoal. The sulphurous acid gas, when existing in a small proportion in air, has the effect of irritating the air-passages so violently that, if accidentally breathed, it would commonly compel the person to leave the spot before the vapours had become sufficiently concentrated to destroy life. Nevertheless, accidents from the combustion of coal and coke sometimes occur.

Symptoms and Appearances.—The following cases will convey a knowledge of the symptoms and appearances which may be met with on these occasions. Some years since, four persons, in a state of asphyxia, were brought into Guy's Hospital. It appeared that on the previous evening they had shut themselves up in the forecastle of a coal-brig, and had made a fire. About six or seven o'clock on the same evening, some of the crew accidentally placed a covering over the flue on the outside, and thus stopped the escape of smoke from the fire, which was made of a kind of coal containing much sulphur. Early in the morning one of the crew, on opening the hatches, observed three of the inmates lying on the floor, unconscious and frothing at the mouth, and the fourth in his crib in a similar condition. The air in the place was most offensive. After the men were brought on deck; one of them, aged twenty-one, began to recover, and when brought to the hospital he seemed only giddy, as if intoxicated: he soon completely recovered. Another, aged forty, after breathing oxygen gas and having brandy and ammonia administered to him, showed no symptoms of recovery, but died in a few hours. A third, aged seventeen, soon began to rally, and in a short time he was able to answer questions: he declared that at the time of the accident he felt no pain, sense of oppression, or weight, either in his head or chest. The fourth, aged fifteen, died the following day, having shown no symptoms of rallying. Stimulants were administered, and warm fomentations were used, but all efforts to produce reaction failed. The appearances presented by these persons when brought in were as follows: the lips were purple, the countenance was livid, and the surface of the body cold; the hands and nails were purple; the breathing was quick and short; the pulse small, quick, and feeble; the pupils were fixed, and there was total insensibility. The body of the man aged forty was inspected four hours after death. The membranes of the brain were congested, and there was a large quantity of fluid under the arachnoid or middle membrane; the sinuses were gorged with blood; the lungs were greatly congested, as were also the right cavities of the heart. It was remarked that, in its congested condition, this body was similar in appearance to that of a hanged culprit. The body of the lad aged fifteen was inspected about thirty-three hours after death. Under the pia mater or inner membrane of the brain was observed one small ecchymosed spot; in the substance of the brain there were more bloody points than usual; a small quantity of fluid was found under the arachnoid membrane, and the sinuses were full of coagulated blood. The lungs showed no congestion, but the right cavities of the heart were much distended with blood. (For a report of cases of recovery from the effects of coal-vapour, see 'Lond. Med. Gaz.,' vol. ix. p. 935, vol. xliii. p. 937; also 'Dub. Med. Press,' Jan. 31, 1849, p. 69.)

In another case, which occurred to Bury and Cullingworth, a woman, residing with her parents, gave the alarm at five p.m. that her father and mother were lying dead in the chamber, having gone to bed in their usual health the previous night. She staggered and seemed so excited that she was charged with being drunk by the police, and was subsequently charged with causing the deaths. The dead bodies of an elderly man and woman were found lying on the bed in the room—the man on his back; the woman resting on her knees with her face buried in the man's thigh, and, on turning her body on to its back, it was observed that the nose had been bleeding. It transpired that the deaths had been caused by the fumes of coke, burning in the fire all night. In the morning the surviving woman awoke, and found her father dead and cold; and her mother said she was dying from suffocation, and she did die shortly afterwards. The daughter was unable to rise from the bed, or to disentangle herself from her dead father until late in the day. She screamed; but it was not till five p.m. that she was able to walk downstairs and give the alarm. On post-mortem examination next day, the body of the man was found lying on the right side in a composed attitude. On the right thigh were two patches of dried blood, and one on the right wrist, which lay close to the thigh. There were several bruises on the body. The heart-cavities contained small clots and a little dark blood. The body of the woman had the skin of the face and the front of the body of a purplish hue, and the nose and lips were swollen as if from a blow. The internal organs were healthy. The heart contained some thin fluid blood, but no clots. The blood of the man was examined, and found to contain distinct traces of carbonic oxide gas. ('Med. Chron.' vol. ii., p. 80.)

A case showing the fatal effects of coal-vapour occurred to Davidson. A man lost his life from sleeping in a closed room with a fire to which there was no flue. The lungs were found gorged with blood, and the windpipe and bronchi were filled with a frothy muco-sanguineous fluid; the mucous membrane beneath was slightly injected; there was a small effusion in each pleural cavity; the right side of the heart was full of dark liquid blood; the dura mater was much injected; the sinuses of the brain and the veins of the pia mater were congested; and there was subarachnoid effusion. The substance of the brain, when cut, presented numerous bloody points. ('Edin. Month. Jour.,' 1847, p. 763.) Other cases are reported in the medical journals, which do not materially differ. As the persons are usually found dead, the post-mortem appearances only can be described. In one instance, a man, æt. 30, and a cat, were found dead in a room in which coal was burnt in a stove provided with an iron pipe to carry off the products of combustion. It was observed, after the fatal event, that this pipe was defective. It had a hole in it from corrosion just before passing through the wall. Sufficient coal-vapour had escaped through this to cause death in a few hours. ('Brit. Med. Jour.,' 1876, i. p. 444.) In the 'Med. Times and Gaz.,' 1852, i. p. 353, the reader will find an account of three cases of recovery from the effects of coal-vapour. (See also, for other cases which proved fatal, the same journal, 1860, i. p. 323.)

The fatal effects of the vapour of burning *coke* are strongly illustrated by the deaths of a mother and six children, varying in age from eight to eighteen years, in Toxteth Park, Liverpool, in 1878. The mother, Ann Cameron, æt. 41, was last seen alive at eleven o'clock at night. Early on the following morning, when the small room in which they slept was entered, she and her children were found lying dead on the floor; and from the appearance of the bodies it was inferred that they had been dead for some hours. There was a strong smell of burning coke in the room; there was an iron bucket containing burnt coke in the middle of the room, and the door and windows had been closed, so that there was no means of ventilation. There was at first a suspicion of suicide, and then of murder, but the circumstances proved that the deaths had resulted from accidental suffocation by coke-vapour. Owing to the smallness of the room, which had a capacity of only 512 cubic feet, the noxious effects of the vapour must have been greatly accelerated.

Full details of the post-mortem appearances met with in poisoning by coke-fumes and the vapours of burning charcoal, are given by La Harpe ('Rev. Méd. de la Suisse Rom.,' 1885, p. 101), and by Cullingworth ('Med. Chron.,' ii. p. 80).

Analysis.—Sulphurous acid is immediately known by its powerful and suffocating odour, which resembles that of burning sulphur. The best test for its presence is a mixture of iodic acid and starch, which speedily acquires a blue colour when exposed to the vapour.

VAPOURS OF LIME, BRICK, AND CEMENT KILNS.

Gaseous Products from Lime-burning.—In the burning of lime, carbonic acid is given out abundantly; but owing to the nature of the fuel used, carbonic oxide and sulphurous acid are mixed with it. Persons who have incautiously slept in the neighbourhood of a burning lime-kiln during a winter's night have been destroyed by the respiration of these vapours. The discovery of a dead body in such a situation would commonly suffice to indicate the real cause of death; but a practitioner ought not to be the less prepared to show that there existed no other apparent cause of death about the person. It is obvious that a person might be murdered, and the body placed subsequently near a kiln by the murderer in order to avert suspicion. If there are no marks of external violence, the stomach should be carefully examined for poison. In the absence of all external and internal injuries, medical evidence will avail but little; for a person might be criminally suffocated, and his body, if found under the circumstances above stated, would present scarcely any appearances upon which a medical opinion could be securely based. The vapours of *brick-kilns* are equally deleterious, the principal agent being carbonic acid mixed with carbonic oxide; although, according to the stage of combustion of the fuel, ammonia, hydrochloric acid, sulphuretted hydrogen, and sulphurous acid may be evolved. In 1842, two boys were found dead on a brick-kiln near London, whither they had gone for the purpose of roasting potatoes. Although the cause of death in both cases was clearly suffocation, in one instance the body was extremely livid, while in the other there was no lividity whatever. Such accidents are frequent. In 1878, an inquest was held at Islington on the body of a man who was found dead on a brick-kiln. There were no burns on the body. A post-mortem examination showed that he had died from suffocation by the noxious gases evolved from the kiln.

The vapours of *cement-kilns* are as noxious as those of brick-kilns: carbonic and sulphurous acids predominate in them.

CONFINED AIR.

Symptoms and Effects.—An animal confined within a certain quantity of air, which it is compelled to breathe, will soon die. A human being in the same way may be suffocated, if confined in a close apartment where the air is not subject to change or renewal, while the products of respiration are accumulated; and the effects are hastened when a number of persons are crowded together in a small space. The change which air, thus contaminated by breathing, undergoes may be very simply stated. The quantity of nitrogen in 100 parts will remain nearly the same; the quantity of oxygen will probably vary from 8 to 12 per cent., while the remainder will be made up chiefly of carbonic acid. If many persons are crowded together, the air will acquire a high temperature, and it will be saturated with aqueous vapour which contains decomposing animal matter derived from the lungs and skin. From this statement, it is evident that air which has been contaminated by continued breathing will operate fatally on the human body, partly in consequence of its being deficient in oxygen, and partly from the noxious effects of the carbonic acid contained in it. The proportion in which carbonic acid exists in respired air is subject to variation: according to the experiments of Allen and Pepys, it never exceeds 10 per cent. by volume of the mixture, how frequently soever it may have been received into and expelled from the lungs. The influence of respiration on air may be thus stated: An adult consumes from one (277 cubic inches) to two gallons of air per minute, and the air expired contains from 4 to 5 per cent. of carbonic acid; but when a person continues to breathe the same air, the proportion of carbonic acid expelled is reduced at each successive expiration. When the amount in air has reached 10 or 12 per cent., no more is thrown off by the lungs, and the blood is no longer depurated. For healthy existance an adult consumes 20 cubic feet, or 125 gallons, of air per hour. A common candle will consume as much as two gallons of air per minute.

These facts are of importance in reference to the size of bedrooms occupied by the poorer classes. The rooms are often small, without ventilation by door, window, or chimney, and fatal accidents, especially to children, are likely to arise from a number sleeping in the same room. Parkes calculated in reference to sleeping-rooms that the minimum cubic space required for boys and girls from fourteen to sixteen years of age should not be less than 500 cubic feet, and above that age from 600 to 800 cubic feet should be allowed per head. In 1878 a woman and six children were found dead in their bedroom at Liverpool. The whole capacity of the room was only equal to 512 cubic feet, *i.e.* about sufficient for one person. In this case a bucket with burning coke (see p. 475) had been placed in the centre of the room, the door and windows closed, and no flue to carry off the coke-vapour. This was, perhaps, the principal cause of death, as the coke must have rapidly exhausted the small quantity of air in the room.

Dalton found that the air in crowded rooms such as theatres, contained one per cent. of carbonic acid, the atmospheric proportion (1-2500th) being therefore increased twenty-fivefold. The author found a similar proportion in the impure air taken from Cornish mines, at a depth of about 1400 feet. The coarse candles used by miners vitiate as much air as the breathing of an adult, and there is an absence of any proper means of ventilation. It is certain that insensibility and death would ensue in a human adult before the whole of the oxygen of the confined air had disappeared; but the opportunity can rarely present itself of analyzing such a contaminated mixture, and hence it is impossible to specify the exact proportion in which carbonic acid would exist when the confined air proved fatal to persons who had respired it. The carbonic acid in the air of close rooms does not gravitate to the floor, but is equally diffused throughout. The whole mass of air is in fact vitiated, and requires renewal. ('Lond. Med. Gaz.,' vol. xxxviii. p. 351; see also 'Report on Mines,' 1864, App. B, p. 196; and 'Chem. News,' Feb. 17, 1865, p. 79.)

Coal-Gas.

Coal-gas is a compound which acts directly as a poison when respired. Many fatal accidents have occurred from the respiration of air contaminated with it. Its composition is subject to much variation, according to circumstances. An analysis of coal-gas as supplied to London showed that it contained per cent.—of hydrogen, 46·43; of light carburetted hydrogen, 38·93; carbonic oxide, 5·62; olefiant gas, 3·86; watery vapour, 2·48; nitrogen, 2·22; carbonic acid, 0·46. The differences in composition depend on the heat to which the gas has been submitted. Poleck found, in four series of experiments in which death was caused in rabbits by the gaseous products of combustion of pit-coal, that the air of the chamber had a mean composition in 100 parts of 6·56 carbonic acid, 0·46 carbonic oxide, 13·4 oxygen, and 79·58 nitrogen. In experiments made with coal-gas the gaseous mixture which caused the death of the animal was always found explosive. He agrees with many others that carbonic oxide is the poisonous agent in coal-gas, except in those cases in which it is largely contaminated with sulphuretted hydrogen gas. In poisoning by charcoal-vapour the effects are due to carbonic acid, carbonic oxide, and the diminution of oxygen. There is no doubt that the hydrocarbons also have a specially noxious influence, although the use of the safety-lamp in mines proves that a mixture of marsh-gas with air in an explosive proportion, may be breathed for a certain time without producing serious effects.

Symptoms and Appearances after Death.—The symptoms produced by coal-gas, when mixed in a large proportion with air, are—giddiness, headache, nausea with vomiting, confusion of intellect, loss of consciousness, general weakness and depression, partial paralysis, convulsions, and the usual phenomena of asphyxia. The appearances after death will be understood from the following cases. A family residing at Strasburg breathed for forty hours an atmosphere contaminated with coal-gas, which had escaped from a pipe passing near the cellar of the house in which they lodged. On the discovery of the accident, four of the family were found dead. The father and mother still breathed, but, in spite of treatment, the father died in twenty-four hours; the mother recovered. When the five bodies were inspected, there was a great difference in the appearances; but the principal changes observed were congestion of the brain and its membranes—the pia mater being gorged with blood, and the whole surface of the brain intensely red. In three of the cases there was an effusion of coagulated blood on the dura mater and in the spinal canal. The lining membrane of the air-passages was strongly injected, and there was spread over it a thick viscid froth, tinged with blood; the substance of the lungs was of a bright-red colour, and the blood in the vessels was coagulated. ('Ann. d'Hyg.,' Jan. 1842.) In two cases communicated by Teale ('Guy's Hosp. Rep.,' 1839, p. 106), there was found congestion of the brain and its membranes, with injection of the lining membrane of the air-passages; and the blood was remarkably liquid. An aged woman and her granddaughter, who had been annoyed by the escape of gas during the day, retired to bed, and they were found dead about twelve hours afterwards. In 1873, four members of a family were found dead in their bedroom at Dundee. The mother, father, and two children had retired to rest quite well. There was a strong smell of coal-gas on entering the room, and they had undoubtedly died from the effects of this gas while sleeping. Gas had been formerly supplied to the house, but it had been carelessly cut off, and some still leaked into the room. These facts show that life may be insidiously destroyed by the breathing of this gas without giving the slightest warning.

In the cases above related, the effects produced by coal-gas were owing to the long-continued breathing of it in a diluted state. The quantity contained in the air of the rooms must have been very small: in the first case it was probably not more than 8 or 9 per cent., because at a little above this proportion the mixture with air becomes explosive; and there had been no explosion in this case, although in the apartment in which the persons were found dead, a stove had been for a long time in active combustion, and a candle had been completely burnt out. In Teale's cases those who first entered the house perceived a strong smell of coal-gas, but still the air could be breathed.

The body of a gasfitter was found supported in a sitting posture on the floor. The man had accidentally breathed coal-gas mixed with air, while connecting a tube with a meter. The skin was cold, the cornea glazed, and the face pale and placid; there was some froth about the mouth, the pupils were rather dilated, and the limbs supple. There was a strong smell of gas in the place. He was working in a closet, and he was found insensible on the top of a pair of steps in a sitting posture—his head on one side, his arms hanging down, and his back leaning against the wall, in the attitude in which he had been engaged at his work. He had evidently died quietly and placidly on his seat, and had made no attempt to descend the steps. He was last seen alive an hour before he was found dead, and he no doubt died rapidly from the inhalation of the gas. An inspection of the body was made about twenty-four hours after death. The skin of the face and upper part of the body was pale—rigidity was well marked, and there was general lividity of the back of the body as well as of the limbs. The blood was everywhere fluid. The brain and its membranes were not congested, but were rather pale than otherwise; the ventricles contained a pale serum. There was a strong odour of coal-gas on exposing the brain. The lungs were of a dark-red colour, and did not collapse on raising the chest-bone; they were dark at the back of the lobes from gravitation of blood; their structure was healthy. The windpipe and bronchi contained frothy mucus in some quantity. A powerful odour of gas was perceived on compressing the lungs. The heart was healthy; the right cavities were distended with blood, and the left were nearly empty; the blood was everywhere dark-coloured. There was congestion of the abdominal viscera, but no other unusual appearance. ('Med.-Chir. Trans.,' 1862, vol. 45, p. 103.) In general the smell of gas may be perceived in the breath for some time after the person has been removed from the noxious atmosphere. In the *Chantrelle* trial at Edinburgh, May, 1878, the time for the disappearance of the odour in a person still living was an important question (p. 169). There are but few facts recorded on this subject. In one case, where sensibility was completely lost, the smell of the gas had entirely disappeared from the breath in two hours and a half after the man's recovery. ('Lancet,' 1878, i. p. 786.)

Coal-gas, like other aerial poisons, may destroy life if long breathed, although so diluted as not to produce any serious effects in the first instance. This gas owes its peculiar odour to the vapour of naphtha; the odour begins to be perceptible in air when the gas forms only the 1000th part; it is easily perceived when forming the 700th part, but the odour is strongly marked when it forms the 150th part. In most houses in which gas is burnt, the odour due to leakage is plainly perceived; and it is a serious question whether health and life may not often be affected by the long-continued breathing of an atmosphere containing but a small proportion. The odour will always convey a sufficient warning against its poisonous effects. It should be known that this gas will penetrate into dwellings in an insidious manner. In Teale's cases (see p. 477, *ante*), the pipe from which the gas had escaped was situated about ten feet from the wall of the bedroom where the women slept; the gas had permeated through the loose earth and rubbish, and had entered the apartment through the floor. We have notes of several other cases in which coal-gas has thus destroyed life by slow leakage into bedrooms. In one of these a gas-pipe passing under the floor had been left imperfectly stopped during repairs. This led to the death of two ladies sleeping in the room above with closed doors and windows. In another, the leakage was owing to a carpenter hammering nails through the floor. Some of these had penetrated a concealed gas-pipe, and led to an escape sufficient to prove fatal to a person sleeping in the room. In a third case, a leakage had been caused by rats gnawing a hole in the thin pipe in which gas is conveyed in houses. Four persons suffered severely by this accident, and barely escaped with their lives.

There is another cause of leakage which may lead to accident. When gas is burnt during the night in a closed bedroom, the flame may be extinguished by a current of air. This would lead to a subsequent escape, which might prove fatal. The action of this gas on the brain and nervous system is so insidious that a person is rendered powerless before he is conscious of danger.

Coal-gas is the agent now employed for the destruction of stray dogs in Paris. Patenko has examined the bodies of animals thus destroyed. The appearances met with are generally those of suffocation (*q.v.*); and the blood, more especially in the liver, is of a rosy hue, as in poisoning by carbonic oxide. ('Ann. d'Hyg.,' 1885, t. 1, p. 207.)

It is impossible to determine exactly what proportion to this gas in air will prove fatal. An atmosphere containing from 7 to 12 per cent. has been found to destroy dogs and rabbits in a few minutes; when the proportion was from 1½ to 2 per cent., it had little or no effect. With respect to man, it may destroy life if long respired when forming about 9 per cent.; *i.e.* when it is in less than an explosive proportion. (See 'Brit. and For. Med. Rev.,' vol. 20, p. 253; also 'Ann. d'Hyg.,' 1830, t. 1, p. 457; and 'Edin. Med. Jour.,' July, 1874, p. 23.) Aldis observed in his experiments that in ordinary coal-gas mixed with air, rats were rendered insensible in half a minute, and died in a minute and a half to two minutes. There was before death a spasmodic action of the diaphragm. The gas was allowed to enter slowly into a bell-jar of air in which the animals were placed. ('Med.-Chir. Trans.,' 1862, vol. 45, p. 100.)

A person may die from respiring a mixture of unburnt gas as well as of the products of its combustion. It is not unusual to find the gas burning in a room in which a person has been asphyxiated. A youth, æt. 18, went to bed in a small room without a fireplace or means of ventilation, in which was a sliding gasalier with two jets. He was found in the morning insensible; the sliding gasalier had been drawn down as far as possible, and one of the jets was burning with the cock turned on full. There was a strong smell of unburnt gas in the room, which had escaped from the sliding tube. When seen he was completely comatose, breathing irregularly; the face was livid, the pupils natural and sensible to light; body-temperature, 102° F. The pillow was stained with a brownish fluid issuing from the mouth. In spite of treatment, he continued in much the same state for nearly three days, when his temperature rose to 106°. The pulse was imperceptible, the pupils dilated and insensible. Death took place sixty-eight hours after he was found. On inspection, the vessels of the surface of the brain were full of blood; small clots appeared on making a section of it. The right auricle of the heart was full of dark blood, fluid and coagulated. The surface of the lungs was of a dark claret colour, mottled with pink spots. The lungs were full of dark blood, and sections of them presented a mottled appearance, like the pleural surface. The bronchial tubes were free—the inner surface was of a dark purple colour. The kidneys were congested. ('Brit. Med. Jour.,' 1875, ii. p. 392.)

NITROUS OXIDE.

Some cases of death from the inhalation of this gas as an anæsthetic renders a short notice of it necessary in this place. Davy was the first to show by experiments on himself that, under certain precautions, it might be breathed when mixed with air without danger to life, and that it had the effect of producing an agreeable species of intoxication.

In 1873, it was administered by a dentist at Exeter to a lady, æt. 38, at her own desire, in order to annul pain during the extraction of a molar tooth. A physician carefully examined her before the operation, and found that there was nothing to preclude the use of the gas. The nitrous oxide was pure: it had been safely used for other patients from the same condenser, and an apparatus was so arranged as to secure the removal of the expired air. The total quantity administered was about six gallons. This could not be regarded as an overdose. Davy himself breathed with safety five gallons in one of his early experiments. Soon after the commencement of the inhalation, it was observed that the pulse became rapid and less full, indicating an action on the heart; the patient was then sensible, and the apparatus was removed. The operation was commenced, but the lady insisted on having the gas again. She took it; insensibility came on, and the operation was completed. Immediately afterwards the face became livid, the features began to swell, and the tongue protruded. In spite of every effort to restore her, she did not recover from the state of insensibility; she breathed two or three times, and the pulse then ceased. No inspection of the body was made. The above-mentioned facts were given in evidence at the coroner's inquest, and the medical opinion was that death had been caused by the gas in producing paralysis of respiration, and that in this case no forethought could have prevented the result. The jury returned a verdict of homicide by misadventure. ('Lancet,' 1873, i. pp. 178, 245, 253.) It has been suggested that on this occasion death may have taken place from suffocation, by blood entering the air-passages; but while there were no symptoms indicative of this, all the facts appear to show that the gas operated as a blood-poison, and destroyed life.

According to the experiments of Joylet and Blanche ('Arch. de Physiol.,' Juillet, 1873), this gas, when breathed, operates fatally by producing pure asphyxia. The insensibility which is a result of breathing the gas, is, in their view, owing to the non-oxygenation of the blood. It is dissolved in the blood and circulated with it, the blood not having the power to separate the combined oxygen from it. According to these physiologists, the anæsthetic state produced by this gas is owing to temporary asphyxia, which, in proportion to its duration and the time for which air is cut off, may end in recovery or death. ('Brit. Med. Jour.,' 1873, ii. p. 141.) There is not only a circulation of unaërated blood, but this liquid containing the nitrous oxide in solution may produce some direct effect on the nerve-centres.

SULPHURETTED HYDROGEN.

This gas has a more powerful action on the body than either carbonic acid or charcoal-vapour. Persons are sometimes accidentally killed by it; but the very offensive odour that a small portion of it communicates to a large quantity of air is sufficient to announce its presence, and thus, with due caution, to prevent any dangerous consequences. Sulphuretted hydrogen gas, when breathed in its pure state, is instantaneously fatal. It exerts equally deleterious effects upon all animals, and through all the textures of the body, but especially through the lungs.

Symptoms.—The symptoms produced by sulphuretted hydrogen on the human body vary according to the degree of concentration in which it is breathed. When in a moderately diluted state, the person speedily falls inanimate. An immediate removal to pure air, and the application of stimulants, with cold effusion, may, however, suffice to restore life. According to the account given by those who have recovered, this state of inanimation is preceded by a sense of weight in the stomach and in the temples; also by giddiness, nausea, sudden weakness, and loss of motion and sensation. If the gas in a still less concentrated state be respired for some time, coma, insensibility, or tetanus with delirium supervenes, preceded by convulsions or pain and weakness over the whole of the body. The skin in such cases is commonly cold, the pulse irregular, and the breathing laboured. When the air is but slightly contaminated with the gas, it may be breathed for a long time without producing any serious symptoms; sometimes there is a feeling of nausea or sickness accompanied with pain in the head or diffused pains in the abdomen. These symptoms are often observed to affect those who are engaged in chemical manipulations with this gas. Sulphuretted hydrogen appears to act like a narcotic poison when highly concentrated, but like a narcotico-irritant when much diluted with air. It is *absorbed* into the blood, deoxidizing it and giving it a brownish-black colour, in which state it is circulated throughout the body. In all cases a noxious atmosphere containing this gas is indicated by an offensive smell producing nausea and sickness. (For a case of poisoning by it, in which the person recovered, see 'Lond. Med. Gaz.,' vol. xliii. p. 871.)

Appearances after Death.—On examining the bodies of persons who have died from the effects of sulphuretted hydrogen, when breathed in a concentrated form, and the inspection is recent, the following appearances have been observed:—The mucous membrane of the nose and throat is commonly covered with a brownish viscid fluid. An offensive odour is exhaled from all the cavities and soft parts of the body. These exhalations, if received into the lungs of those engaged in making the inspection, sometimes give rise to nausea and other unpleasant symptoms, and may even cause syncope or asphyxia. The muscles of the body are of a dark colour, and are not susceptible of the electric stimulus. The lungs, liver, and the soft organs generally are distended with black liquid blood. There is also great congestion about the right side of the heart, and the blood has been found everywhere liquid and dark-coloured; the body rapidly undergoes putrefaction. When death has occurred from the breathing of this gas in a more diluted form, the appearances are less marked. There is then general congestion of the internal organs, with a dark and liquid state of the blood. In fact, in such cases the appearances can scarcely be distinguished from those produced by carbonic acid. Four men lost their lives in the Fleet Lane Sewer in 1861; they were found dead, and there was no doubt that sulphuretted hydrogen was the cause of death. The eyes and mouth were open, the lips and tongue livid, the pupils widely dilated, the blood black and fluid, the lungs congested, the heart full of black fluid blood, the right side gorged, and there was a bloody froth in the windpipe. In the brain the large vessels of the dura mater were full of black fluid blood. ('Lancet, 1861, i. p. 187.)

In 1857, six persons lost their lives at *Cleator Moor*, near Whitehaven, by breathing sulphuretted hydrogen in a diluted form, by reason of their having slept in small, close, ill-ventilated rooms, into which the gas had penetrated. Three of the deceased persons—a husband, wife, and child, of one family (*Armstrong*)—had retired to rest, in their usual health, on the night of June 9th. Two of them were found the next morning dead in bed, and a third (the child) was found in a state of insensibility, and lingered until the afternoon of the same day, when she died. The fourth, a healthy adult, retired to sleep in his bed with his door closed, and he was found dead in *an hour*. The fifth, a child, was taken ill on the morning of the 11th, and died the same day. The sixth was taken ill on the morning of the 10th, and died on June 12th. The symptoms complained of by some who recovered were nausea, sickness, giddiness, and insensibility. In the body of one child, the pupils were found dilated; viscid mucus escaped from the nostrils; there was congestion of the lungs and kidneys, as well as of the membranes of the brain. In the adult who died in an hour, the pupils were natural, the jaws firmly clenched, the fingers contracted, and the nails blue; there was great cadaveric lividity, and a quantity of fluid with frothy mucus issued from the nostrils and mouth. The lungs were much congested, and serum was effused in the cavity of the chest. The heart contained a little fluid blood, and was somewhat flaccid. The mucous membrane of the windpipe and gullet was redder than natural, and in the former there was frothy mucus. The stomach, as well as the large and small intestines, were highly congested, but otherwise healthy. The brain and its membranes were greatly engorged with blood, which, as in the body generally, was very dark and fluid. The cottages in which the accidents had occurred were built upon a heap of iron-slag, which also abutted on the premises behind. The slag contained, among other matters, sulphide of iron and sulphide of calcium. A foul smell, compared to that of cinders extinguished by water, had for some time been perceived about the rooms, chiefly at night when the doors and windows were closed; and the day before the occurrence a heavy storm of rain had washed through the slag-heap, and aggravated the effects. The heap of slag was burning in certain parts, and sulphuretted hydrogen was evolved in large quantities at a depth of a few feet below. A fortnight after the deaths, on removing the stone pavement in the lower rooms, the slag below was found damp, and sulphuretted hydrogen was still issuing from it. The white-lead paint in the closets was partly converted into black sulphide, and this chemical change was found in patches on the chamber-door of one small room in which two persons had died. The symptoms, so far as they were observed in the living, the appearances in the dead bodies, and the chemical nature of the wet slag beneath the foundation, left no reasonable doubt that during the night, with the doors and windows closed, sulphuretted hydrogen had escaped in sufficient quantity to poison the air and destroy life, and a verdict was returned to this effect. A suggestion was made that carbonic acid might have caused the symptoms and death, but there was no source of carbonic acid but the breath; and there is no instance known of any adult having breathed himself to death in an hour, in a room containing 600 cubic feet of air,—not to mention that persons had slept in similar rooms in the same row of cottages, at a distance from the slag-heap, without perishing from such a cause. Another theory was put forward, to the effect that carbonic oxide in the vapours of some blast-furnaces had found its way into the rooms where these persons had died; but the nature of the locality and the distance of the furnaces rendered this impossible. Persons who had left their windows open, whereby these vapours might have entered, escaped, while the deaths occurred only in those houses in which the doors and windows were completely closed. It is highly probable that the sulphuretted hydrogen was mixed with other gases and vapours, as it is never found pure except in a chemical laboratory; but the circumstances proved left no doubt that this gas was the principal agent of death. This seems to have been clearly established by the fact that, after a channel for drainage had been cut through the slag-heap and the slag removed, no casualty took place.

As in reference to carbonic acid, an atmosphere which may be breathed for a short time with impunity will ultimately destroy life. Sulphuretted hydrogen in a fatal proportion, however diluted or mixed with other vapours, would always be indicated by a disagreeable smell; although from habit, as well as probably from the effects of the gas on the nervous system, this offensive smell might not be perceived when a person had remained for a short time in the poisoned atmosphere. In the cases of the *Halls*, which occurred at Sheffield in 1852, there is reason to believe that the deaths of two persons were caused by the smouldering of ashes in a cesspool. ('Assoc. Med. Jour.,' April, 1853, p. 280.) Haywood considered that carbonic acid was the agent in this case, although it is probable, from the nature of the materials in which combustion was going on, that sulphuretted hydrogen and other gases and vapours were simultaneously evolved.

Effluvia of Drains and Sewers.—The most common form of accidental poisoning by sulphuretted hydrogen (for it is rare that a case occurs which is not purely accidental) is witnessed among nightmen and others who are engaged in cleaning out drains and sewers, or in the removal of nightsoil. According to Thénard, there are two kinds of mechanical mixtures of gases which are commonly met with in the exhalations of privies. The first compound consists of a large proportion of atmospheric air, holding diffused through it sulphide of ammonium in the form of vapour. The sulphide is contained abundantly in the water of the soil, and is constantly rising from it in vapour, and diffusing itself in the surrounding atmosphere. It is this vapour which gives the unpleasant and pungent odour to the effluvia, and causes an increased secretion of tears in those who unguardedly expose themselves to such exhalations. The *symptoms* produced by the respiration of this gaseous mixture, when in a concentrated state, bear a close resemblance to those which result from the action of sulphuretted hydrogen gas. If a person is but slightly affected, he will probably complain of nausea and sickness; his skin will be cold, his respiration free, but irregular; the pulse is commonly frequent, and the voluntary muscles, especially those of the chest, are affected by spasmodic twitchings. If more strongly affected, he loses all power of sense and motion; the skin becomes cold, the lips and face assume a violet hue, the mouth is covered by a bloody and frothy mucus; the pulse is small, frequent, and irregular; the breathing hurried, laborious, and convulsive; and the limbs and trunk are in a state of general relaxation. If still more severely affected, death may take place immediately; or, should the person survive a few hours, in addition to the above symptoms, there will be short but violent spasmodic twitchings of the muscles, sometimes even accompanied by tetanic spasms. ('Ann. d'Hyg.,' 1829, t. 2, p. 70.) If the person is sensible, he will commonly suffer severe pain, and the pulse may become so quick and irregular that it cannot be counted. When the symptoms are of such a formidable nature, it is rare that a recovery takes place. The *appearances* met with on making an examination of the body are similar to those observed in death from sulphuretted hydrogen. The inspection should be made with caution, for a too-frequent respiration of the poisonous exhalations may seriously affect those who undertake it. ('Ann. d'Hyg.,' 1872, t. 2, p. 73.) The admixture of any mineral acid with the sewage liquid containing sulphide of ammonium produces an immediate escape of sulphuretted hydrogen in fatal proportion. This operates more speedily than the mere agitation of the liquid. In 1876, a man lost his life in a London sewer owing to the sudden influx of refuse acid liquid from a factory, which caused a sudden escape of the poisonous gas. The editor has on several occasions found that men working in sewers are rendered insensible, comatose, and blue and livid on the surface of the body, owing to the discharge of acid liquids from soda-water factories into the sewers. The acid liberates a mixture of carbonic acid and sulphuretted hydrogen from the deposits in the sewer; and these gases overpower the workmen who are exposed to their influence.

Analysis.—The recognition of these gases and vapours is a simple operation. The odour which they possess is sufficient to determine their presence, even when they are diluted with a large quantity of atmospheric air. *Sulphuretted hydrogen gas* is at once identified by its action on paper previously dipped in a solution of a salt of lead: if present, even in very small proportion (the 1-100,000th part), the moistened paper speedily acquires a brownish-black stain from the production of sulphide of lead. It must not be supposed that sulphuretted hydrogen, when it has proved fatal in a *diluted* form, can be detected in the lungs, stomach, or blood of a dead body. When the body is recently removed from a drain or sewer, the gas may be found pervading the whole of the tissues; but in other cases it will be as useless to look for it as for carbonic acid in poisoning by this gas. Noxious gases are not long retained by the tissues; a short exposure will suffice to remove all traces of them. The examination of the locality can alone throw a light upon the cause of death. The proportion of the gas found in an apartment will, however, rarely be a criterion of the actual quantity which has destroyed life. A person going into a room where the deceased bodies are lying may notice only a disagreeable or stifling smell, but he may be able to breathe for a longer or a shorter period with the door or window open. It is not the respiration of a few minutes, but the breathing of the diluted noxious atmosphere for hours, that really destroys life. The best method of detecting sulphuretted hydrogen when present in a dead body (not putrefied) is to place a slip of card glazed with lead, in the muscles or soft organs: it will sooner or later be tarnished and acquire a brown colour, if the gas is present.

Sulphuretted hydrogen may be proved to exist by the lead-test in the vapour of *sulphide of ammonium* when mixed with air, while the presence of ammonia in the compound is indicated by its volatile alkaline reaction on test-paper—also by holding, in a vessel containing the vapour recently collected, a rod dipped in strong hydrochloric acid: the production of dense white fumes announces the formation of chloride of ammonium. The presence of this compound vapour in any mixture is at once indicated by introducing paper wetted with a solution of nitro-prusside of sodium. The sulphide produces with it a rich crimson colour; if sulphuretted hydrogen alone is present, the nitro-prusside paper undergoes no change. It is a fact which cannot be too universally known that a candle will readily burn in a mixture of either of these gases with air which, if breathed, would suffice to destroy life. The candle-test should be applied with caution in places where these effluvia are collected and confined in sewers or close cesspools. When sulphuretted hydrogen is diffused in a proportion of about 7 per cent. with air, it forms a dangerously explosive mixture.

It is worthy of remark that the air of a cesspool may be often breathed with safety until the workmen commence removing the soil, when a large quantity of mephitic vapour may suddenly escape, which will lead to the immediate suffocation of all present. Several persons have been killed by trusting to the previous burning of a candle, in ignorance of this fact. In an accident which occurred in Whitechapel, in 1857, three men died speedily from breathing the vapour of an old sewer, and two others nearly lost their lives in attempting to assist them. According to Parent-Duchâtelet, men can work for a time in an atmosphere containing from 2 to 3 per cent. of sulphuretted hydrogen. The air of one of the principal sewers of Paris gave the following results on analysis, in 100 parts:—Oxygen, 13·79; nitrogen, 81·21; carbonic acid, 2·01; sulphuretted hydrogen, 2·99.

Another gaseous mixture, in the form of deoxidized air, was found by Thénard in the sewers of Paris: it was composed, in 100 parts, of nitrogen 94, of oxygen 2, and of carbonic acid 4. Sometimes the carbonic acid is combined with ammonia, and then it may be regarded chiefly as a mixture of nitrogen holding diffused through it the vapour of carbonate of ammonium, which is sufficient to render it highly irritating to the mucous membrane of the eyes and nose. Its action on the human body when breathed will be readily understood from its chemical composition. In its operation it is essentially negative, and destroys life by cutting off the access of oxygen. The small proportion of carbonic acid or of carbonate of ammonium existing in it could not give rise to the asphyxia which so rapidly followed its inhalation. The chances of recovery are much greater in persons who become asphyxiated from the inspiration of this compound than in those who are exposed to the influence of the preceding. Commonly the immediate removal to a current of pure air is sufficient to bring about a recovery. Should death take place, it will be found on inspection that the internal appearances are the same as those which are met with in death from suffocation.

Analysis.—This compound has no offensive smell; it extinguishes a lighted candle; the carbonic acid contained in it may be removed by caustic potash, and then it will be seen that the great bulk of the mixture is formed of nitrogen—a gas which, by its negative properties, cannot be easily confounded with any other. In a mixed atmosphere of carbonic acid and sulphuretted hydrogen, the two gases may be separated by agitating the mixture with a solution of acetate of lead, and treating the precipitate with acetic acid, which dissolves the carbonate, and leaves sulphide of lead.

LIGHTNING. COLD. HEAT. STARVATION.

CHAPTER 43.

EFFECTS OF ELECTRICITY.—POST-MORTEM APPEARANCES.—COLD AN OCCASIONAL CAUSE OF DEATH.—SYMPTOMS.—CIRCUMSTANCES WHICH ACCELERATE DEATH.—POST-MORTEM APPEARANCES.—EFFECT OF HEAT.—STARVATION A RARE CAUSE OF DEATH.—SYMPTOMS.—APPEARANCES AFTER DEATH.—LEGAL RELATIONS.

Lightning and Electricity.

Deaths from lightning are more common than is generally supposed. Although they usually occur under circumstances in which the facts are known, yet cases may present themselves in which the marks of violence left upon the dead bodies may be suggestive of homicide. Few or no statistics of these deaths have been published in England; but in France the facts collected by Boudin show the following results. In twenty-eight years—from 1835 to 1863—2238 persons were killed by lightning. From 1854 to 1864 inclusive, 967 persons were killed, 698 being males and 269 females. In the year 1864 alone there were 87 killed, 61 males and 26 females. Of 34 persons killed by lightning in the open fields during the year 1853, 15 were struck while taking shelter under trees; and of 107 persons killed by lightning between 1841 and 1853, 21 are reported to have been killed under trees. Children appear to escape this mode of death more than adults. ('Chem. News,' 1865, July 7 and Dec. 8.) In the Registrar-General's reports, the number of deaths from lightning in England and Wales for nine years (1869–1878) was 182, of which 147 were males. In 1880 the number was 26. These returns do not show the actual number of deaths. In Prussia registration is compulsory, and in that country during the same period 819 persons were reported to have been killed by lightning. ('Brit. Assoc. Rep.,' Aug. 1878.)

Cause of Death.—Electricity appears to act fatally by producing a violent shock to the brain and nervous system. In general there is no sense of pain; the individual falls at once into a state of unconsciousness. In a case which did not prove fatal, the person, who was seen soon after the accident, was found labouring under the following symptoms:—Insensibility; deep, slow, and interrupted respiration; entire relaxation of the muscular system; the pulse soft and slow; the pupils dilated, but sensible to light. ('Lond. Med. Gaz.,' vol. xiv. p. 654.) It will be seen that these are the usual symptoms of concussion of the brain. The effect of a slight shock is that of producing stunning; and when persons who have been severely struck recover, they suffer from noises in the ears, paralysis, and other symptoms of nervous disorder. ('Med. Times,' July 15, 1848.) Insanity has even been known to follow a stroke of lightning. (Conolly's 'Rep. of Hanwell,' 1839.) In one case the person remained delirious for three days, and when he recovered he had completely lost his memory. ('Lancet,' 1839, II. p. 582.) A boy, æt. 4, received a severe shock on May 11th, was seized with tetanus on the 13th, and died in four hours. ('Med. Times and Gaz.,' 1855, i. p. 533.) In another instance, an old man who took shelter under a tree felt as if a vivid flash had struck him in the face; he did not fall, but he became almost blind. He suffered for some days from frontal headache, and loss of sight supervened. ('Med. Times and Gaz.,' 1858, i. p. 90.) Under slight shocks the principal symptoms, which soon disappear, are headache and confusion of intellect.

It may be observed of the effects of lightning generally, that death is either immediate or the individual recovers. A person may, however, linger, and die from the effects of severe lacerations or burns indirectly produced. In a case which occurred in 1838, death was thus caused indirectly by the effects of electricity. The following case of recovery illustrates further the action of electricity. Three persons were struck by lightning at the same time. In one, a healthy man, æt. 26, the symptoms were severe. An hour and a half after the stroke he lay completely unconscious, as if in a fit of apoplexy; his pulse was below 60, full and hard; respiration snoring, pupils dilated and insensible. There were frequent twitchings of the arms and hands; the thumbs were fixed and immovable, and the jaws firmly clenched. Severe spasms then came on, so that four men could scarcely hold him in his bed; and his body was drawn to the left side. When these symptoms had abated, he was copiously bled; cold was applied to the head, a blister to the nape of the neck, and mustard-poultices to the legs. Stimulating injections and opium were also administered. In the course of twenty-four hours consciousness slowly returned, and the man soon completely recovered. The only external injury discoverable was a red streak, as broad as a finger, which extended from the left temple over the neck and chest: this disappeared completely in a few days. ('Brit. and For. Med. Rev.,' Oct. 1842.) These red streaks or marks sometimes assume a remarkable disposition over the skin. ('Vierteljahrsschr. für Gerichtl. Med.,' 1863, p. 308.)

Appearances after Death.—The suddenness of death is such that the body sometimes preserves the attitude in which it was struck ('Med. Times and Gaz.,' 1860, i. p. 167), and there may be no appearances, and no physical changes in the body or dress, to indicate the mode of death. Five negroes were simultaneously prostrated by a single stroke of lightning. Three, including two children, were instantaneously killed. The only mark of injury found on one, an adult female, was a burnt spot, the size of a dollar, under the right axilla, and this woman's clothes were set on fire. ('Dub. Med. Press,' May 14, 1845.) Persons involved in the same flash do not all suffer equally. A man, a woman, and a boy were simultaneously struck in an open field. The man heard the thunder; he felt his hat thrust down upon his head, as if by violent pressure. The boy was confused and unsteady, but conscious. The woman was lying on the ground, speechless and moaning; she soon recovered; she had heard no thunder, and saw no lightning. ('Brit. Med. Jour.,' 1876, i. p. 102.) Those who are severely struck do not hear the thunder. Generally speaking, there are, externally, marks of contusion and laceration about the spot where the electric current has entered or passed out: sometimes a severe lacerated wound has existed; on other occasions there has been no wound or laceration, but an extensive ecchymosis, which, according to Meyer, is most commonly found on the skin of the back. In one instance, which occurred in London in May, 1839, there were no marks of external violence; and several similar cases are quoted from American journals. ('Med. Times,' 1845, I. p. 82.) The clothes are in almost all cases rent and torn, and partially singed, giving rise to a peculiar burnt odour,—sometimes even rolled up in shreds and carried to a distance. They are occasionally found partially burnt, but this is not a frequent occurrence. Metallic substances about the person present traces of fusion, and articles of steel have been observed to acquire magnetic polarity. West met with the case of a boy, æt. 18, instantly struck dead by lightning, where a knife in the pocket had strong magnetic polarity. This case further shows that which has frequently been noticed—namely, that while much violence has been done to the dress, the parts of the body covered by it have escaped injury. The deceased wore at the time of the accident a pair of strong leather boots; these were torn to shreds, probably owing to the presence of iron nails in the soles, but the feet of the deceased presented no mark of injury. An accident by lightning occurred, in which a man was instantaneously killed. A cap which the man wore had a hole through it; his hair was singed, his shoes were burst open, and his trousers torn. The woodwork of the building down which the electricity passed was merely split, and there was no mark of burning. We have examined, in several instances, the wood of trees which have been struck by lightning: in each case it has presented only the appearance of rending by mechanical force, the inner bark being torn from the alburnum.

Wounds and burns are sometimes met with on the body. The wounds have commonly been lacerated punctures, like stabs produced by a blunt dagger. In the case of a person who was struck but not killed, a deep wound was produced in one thigh, almost laying bare the femoral artery. This person was struck, as many others have been, while in the act of opening an umbrella during a storm. Fractures of the bones have not been commonly observed; in a case mentioned by Pouillet, the skull was severely fractured and the bones were depressed.

In 1864, Mackintosh was called to see three persons who had been struck by lightning about *twenty minutes* previously. They had taken shelter under a haystack, which had been set on fire by the same flash. 1. A boy, æt. 10, was then able to walk, although unable to move his legs immediately after the occurrence. All that he remembered was that he saw the stack on fire and called to his father; he felt dizzy all over, and unable to move. His hair and clothes were not singed, and the metallic buttons on his dress showed no signs of fusion. On removing his clothes a slight odour of singeing was perceptible. He complained of pain in the lower part of the abdomen. There were several red streaks, of about a finger's breadth, running obliquely downwards and inwards on either side of the chest to the middle line in front of the abdomen; they then descended over the pubes, and were lost in the perineum. It does not appear that there was any abrasion of the skin. This boy perfectly recovered; the red streaks disappeared gradually, and could hardly be traced four days after the injury. 2. Another boy, æt. 11, lay prostrate and unconscious, with an expression of grim terror and suffering; he frothed at the mouth, moaned piteously, and flung his legs and arms about in all directions. The breathing was deep, slow, and laborious; the heart palpitating, the pulse weak and very irregular; the pupils dilated, and insensible to light. There were in this case several red streaks converging from the neck and shoulders to the middle of the chest-bone, and passing over the abdomen until they were lost on the pubes. There were similar streaks radiating for a few inches from the tuber ischii on each hip in different directions, until they were lost in the skin. It appears that this boy was in a sitting posture when struck. The hair on the back of his head and neck was singed, and the peculiar odour of singeing was perceived, although his clothes showed no traces of burning, nor the metallic buttons of fusion. The boy became conscious in five hours, and rapidly recovered. The red streaks gradually disappeared, leaving marks of a scaly glistening white appearance, which ultimately left no trace of their existence. 3. A man, æt. 46. Like the two others, he was in a sitting posture, and he appeared to have been killed on the spot; he had not moved hand or foot. The countenance was placid, and the pupils were widely dilated. There was a large *lacerated wound* of the scalp, at the junction of the occipital with the parietal bones, but without any fracture. The electric current appeared to have passed down each side of the head, between the soft parts and the cranium. On the left side it had passed downwards in front to the left ear, and terminated on the side of the neck, rupturing blood-vessels and muscles, and causing swelling of the parts with effusion of blood. It presented the appearance of an extensive bruise caused by mechanical violence. On the right side the current had passed down to the space above the collar-bone, causing lividity and swelling of the right ear as well as of the adjacent skin; and it terminated in a dark-blue mangled patch of skin, in which there were several free communications with the surface. The hair on the back of the head was slightly singed, and that in front of the chest was singed quite close to the skin, but the hair which covered the wound in the scalp, where the current had entered, was uninjured. The clothes were neither torn nor burnt, and the metallic buttons were not fused. The clothes of all three were very wet. The hat was not examined. The left side-pocket of the trousers contained several lucifer-matches and a tin tobacco-box, which were unaffected by the electric discharge. The right pocket contained a knife, which had acquired strong magnetic polarity. The body was placed in a warm room, and it is worthy of remark that cadaveric rigidity came on in fourteen hours after death. ('Lancet,' 1864, ii. p. 118.) It is to be regretted that no post-mortem examination was allowed. It is probable that the brain sustained severe injury, causing immediate death. These cases singularly present the effects of lightning in three degrees—the effect of a slight shock in No. 1, of a severe shock in No. 2, and of a fatal shock in No. 3. There was but little bodily injury in any case, and no appearance of burning. The marks on the skin in Nos. 1 and 2 could not have been mistaken for violence, but the wound to the scalp and the injuries to the neck in No. 3 might have been ascribed to the violence of another, had not the circumstances been fully known. The clothes probably escaped burning or tearing by reason of their being wet, and their readily conducting electricity.

The *burns* occasionally found on the bodies of persons who have been struck by lightning have been hitherto ascribed to the ignition of the clothes. It appears, however, from the subjoined cases, that burns even of a severe kind may be the result of a direct agency of electricity itself upon the body. Geoghegan met with the case of a girl who had been struck by lightning: there was burning of the thigh and buttocks to the first and second degrees, but the clothes did not show any signs of combustion. In 1852, a man, æt. 23, while engaged in milking a cow in a wooden shed, during a severe thunderstorm, suddenly observed a vivid flash of lightning, which killed the cow instantly, and inflicted serious injuries upon himself. He was seen sixteen hours after the accident, and a severe burn was found on his person, extending from the right hip to the shoulder, and covering a large portion of the front and side of his body. His mind was then wandering, and there were symptoms of inflammatory fever. The man was confined to his bed for seventeen days, at the end of which time the injuries had not perfectly healed. On examining his dress, the right sleeve of his shirt was found burnt to shreds, but there was no material burning of any other part of the dress. The case is singular, inasmuch as it shows that the dress may be burnt without the surface of the body being simultaneously injured; and further, that a burn may be produced on the body, although the clothes covering the part may have escaped combustion.

Fleming has described the cases of eight persons who were struck by lightning, and on the bodies of some of these there were marks of severe burns. The dresses were in parts much singed. These cases show, in a remarkable manner, the intense heat evolved in the instantaneous passage of the electric current through the clothes and body. The persons struck were benumbed or paralyzed in various degrees, but all ultimately recovered; the burns were so severe that some months elapsed before they were entirely healed. ('Glasgow Med. Jour.,' Oct. 1859, p. 257.) A man was struck by lightning in 1861. Externally there was a burn upon the nape of the neck, where the metallic watchguard rested; and from the point where the current of electricity left the chain, the skin was blistered in a straight line down to the feet, scorching the hair of the pubes in its course. The man's intellect was confused, and his general condition was that of collapse. With the aid of stimulants he became sufficiently restored to communicate his feelings. There was paralysis of the legs, with loss of sensibility (anæsthesia) and retention of urine. He was deaf, and complained of a noise in his ears like thunder; he had some difficulty in articulating, and pain in swallowing, with a peculiar metallic taste in his mouth. The anæsthesia passed away in half an hour, but he did not completely recover the use of his limbs for four days; the bladder was paralysed for twenty-four hours; the urine was high-coloured, and contained an abundance of phosphates. The bowels were confined. All these symptoms gradually disappeared, excepting slight deafness, and the man was discharged convalescent.

The following complete account of the external and internal appearances found in the body of a healthy middle-aged labourer, who was killed by a stroke of lightning, has been published by Schaffer. The man was working in the fields with several other labourers, just after a thunderstorm had passed over and had apparently subsided. He was endeavouring to kindle a light with a flint and steel, when the lightning struck him. For a moment after the shock he stood still, and then his body fell heavily to the ground lifeless. The electric current had entered at the upper part of his forehead, perforating and tearing his hat at that part; it seemed then to have become divided into two currents, which passed down the sides of the body along the lower limbs and out at the feet. On the upper part of the forehead was found a soft swelling, of a dark-blue colour, and about the size of the palm of a hand; the hair which covered it was uninjured. From this spot two dark-red streaks proceeded in different directions. One of these passed to the left, running over the temple in front of the left ear, down the neck to the surface of the chest, over which it passed between the left nipple and the armpit; and so made its way over the body to the left inguinal region, where it formed a large, irregular, scorched-looking patch on the skin. From this point the dark-red streak again continued its downward course, passing over the great trochanter of the femur, then along the outer surface of the left leg to the back of the foot, where it terminated in several small dark-blue spots. The other streak, which proceeded from the ecchymosed swelling on the forehead, passed directly to the right ear, which was considerably swollen and of a dark-blue colour; from the ear it ran downwards and backwards along the neck, crossed the right border of the scapula, and eventually reached the right groin, where a scorched patch of skin, similar to that in the left groin, was found. From this part the discoloured streak continued down the outer side of the right leg, to its termination on the back of the foot, just on the left side. The hair on the forehead, as well as that which occurred in any part of the track taken by the electric current down to the groin, was not burnt, yet at the groin itself, and at every part hence to the foot over which the electric current had passed, the hairs were completely burnt. The cause of the skin and hair in the groins being burnt is probably to be referred to the buckles of a belt which the man wore round his abdomen at the time of the accident: the belt was completely destroyed. Nothing further worthy of notice was observed on the exterior of the body, with the exception of the face being very red. The swelling of the head was found to be due to the presence of a large quantity of extravasated blood. The bone beneath was not injured. About four ounces of blood had been effused in other parts of the scalp corresponding to the swollen discoloured patches outside. The vessels of the cerebral membranes were greatly congested, and the brain itself contained much blood, especially observed in the choroid plexuses. A large quantity of reddish mucus was found in the larynx, windpipe, and air-tubes. The lungs were loaded with dark blood; there was a great deficiency of blood in the cavities of the heart and in the large vessels. The blood-vessels of the stomach and intestines were more than usually congested. The right lobe of the liver was of a dark-red colour, and loaded with blood, especially the part which corresponded to the burnt patch of skin at the lower part of the abdomen. The spleen also was large, and filled with blood. Much blood was found accumulated in the substance of the muscles of the abdomen, at those parts which lay beneath the burnt surfaces outside. ('Oesterreich. Med. Wochenschrift,' June 6th, 1846.) It was formerly supposed that the blood was never found coagulated in persons killed by lightning, and that the body did not become rigid after death. Experience has shown, however, that these statements are not in accordance with observed facts.

Ecchymoses resembling those produced by mechanical violence and of great extent are sometimes met with. A short, muscular man was killed by lightning. There was a strong smell of burning about the body. The hair was singed considerably at the back of the head, at the nape of the neck, and slightly above the forehead, at each corner of which there was a dark ecchymosis. The scalp was greatly ecchymosed at the top and at the back of the head. There was a large ecchymosis at the nape of the neck, and from this a livid band half an inch broad curved round the right side of the neck, and terminated in a large ecchymosis at the sternal end of the right clavicle. The left forearm was scorched in front, and along the centre of the scorched surface ran a dark line about three or four lines broad. There were slight ecchymoses on the right thigh, and on the right side of the scrotum. About half-way down the right leg was an extensive scorch encircling the leg, and a line of about three quarters of an inch in breadth ran down the inner side of the leg to the sole. The soles of both feet were extensively blistered, and the cuticle charred. The clothing corresponding to the injured parts was extensively scorched, and large holes were burnt in the soles of the socks. The boots were scorched inside, but not injured outside, although there were iron nails in the soles. Excepting the nails in the boots, there was no metal about the body. The pupils were widely dilated. Cadaveric rigidity was unusually marked, requiring great force to overcome it. The inner surface of the scalp was ecchymosed. The brain appeared bloodless and soft, and there was but little fluid in the ventricles. The veins and sinuses of the base were filled with dark fluid blood. The heart was flabby; the right ventricle contained a small quantity of dark fluid blood; the great veins were distended with very dark blood, everywhere perfectly fluid. There was no coagulum or clot in any part, and the blood showed no tendency to coagulate after its escape. The lungs were very soft and much congested posteriorly. ('Med. Times and Gaz.,' 1865, ii. p. 418.) The external injuries in these cases resemble those caused by violence, but the peculiar form, extent, and direction of the ecchymoses, as well as the presence of marks of burning, either on the clothes or the body, were sufficient to distinguish them as injuries produced by electricity.

For a description of the minor effects of electricity, the reader is referred to the cases of two club servants struck by lightning in London in Jan. 1885. ('Brit. Med. Jour.,' 1885, i. p. 458.) Mackay also describes the curious marks he met with on a boy struck by lightning. ('Edin. Med. Jour.,' 1883, ii. p. 560.)

Deaths resulting from the application of electricity for illuminating purposes have, within the last few years, occurred with some frequency. A case is recorded where a young man at a theatre, out of curiosity, touched two conducting wires from a dynamo-machine. He fell senseless, and died in forty minutes. A sailor on board the Imperial Russian yacht *Livadia* touched the wires of the machine, and was struck dead almost immediately. A gardener was found dead at Hatfield House, in the neighbourhood of the conducting wires of a dynamo-machine;

and these he was supposed to have touched accidentally. Still more recently, two men perished in Paris by accidentally coming in contact with some conducting wires whilst climbing a wall. In 1884, a man at the Health Exhibition in London died in a moment from grasping the two wires of a dynamo-machine which he was engaged in cleaning. The appearances met with in the Parisian cases have been recorded ('Ann. d'Hyg.,' 1885, t. 13, p. 53), and also those observed on the man killed at the Health Exhibition. ('Brit. Med. Jour.,' 1885, i. p. 550.) In this latter case, on the outer side of the left fore-finger was a small elongated blister, about half an inch in length, which had the appearance of a burn; but there was no surrounding congestion of the skin, nor any smell of charred skin. Some of the epidermic cells of the skin raised by the blister appeared as if fused together.

Electricity has, singularly enough, been employed for *suicidal* purposes. In 1885, Paul Thiebault, with this intent, deliberately took hold of the conductors of a dynamo machine at the works of M. Chertemps, in Paris, and was instantaneously killed. ('Brit. Med. Jour.,' 1885, i. p. 550.)

Legal Relations.—Rare as the combination of circumstances must be in which a medico-legal question can arise in reference to the action of the electric current on the body, a case was tried in France, in 1845, in which medical evidence respecting the characters of wounds caused by electricity was of considerable importance. In August of that year, some buildings were destroyed at Malaunay, near Rouen—as it was alleged on the one side, by a thunderstorm, on the other, by a whirlwind; and as the parties were insured against lightning, they brought an action for recovering the amount insured. The evidence in favour of the accident having been due to electricity consisted, first, in the alleged carbonized appearance of the leaves of some trees and shrubs growing near; and, secondly, in the characters of the wounds on the bodies of several persons who were injured at the time of the occurrence. Lesauvage stated at the trial that there was an appearance of dark stains scattered over the bodies, and that those who survived suffered from torpor, pains in the limbs, and a partial paralysis of motion. He observed, also, that decomposition took place very speedily in the bodies of those who were killed. In one instance the muscles were torn and lacerated, and some small arteries divided. This witness attributed most of the wounds to the effects of electricity. Funel deposed that, in each of the dead bodies which he had examined, the face and neck were bloated and discoloured, as if death had taken place from asphyxia. It did not appear, however, that there were any circumstances decisively proving that the buildings had been destroyed by lightning. Pouillet gave an accurate description of the storm: he believed that although, as deposed to by some of the witnesses at the trial, it might have been attended with thunder and lightning, the buildings with the surrounding trees were really overthrown by the mere force of the wind, and not by lightning. The description given bears out this view, but at the same time it is unusual that trees, when struck, unless old or dry and withered, should present any marks of combustion about the leaves or trunk. ('Comp. Rend.,' Sept. 1845; also 'Lond. Med. Gaz.,' vol. xxxvi. p. 1133.) The scientific evidence was of the most conflicting kind. The Royal Court of Rouen decided that the disaster was occasioned by the atmosphere; and, without entering into the various theories of storms, condemned the insurance companies to pay the amount claimed. ('Law Times,' March 14, 1846, p. 490.)

Cold.

Cause of Death.—The protracted exposure of the human body to a low temperature may destroy life; and although in this country cases rarely occur in which cold alone operates fatally, it is not unusual, during a severe winter, to hear of persons in a state of misery and destitution being found dead in exposed situations. On these occasions we may reasonably suspect that the want of proper food and nourishment has accelerated death. It is, however, convenient to make a distinction between the effects of cold and of starvation on the system, as the symptoms preceding death, and the rapidity with which it takes place, are different in the two cases.

Symptoms.—A moderate degree of cold is well known to have an invigorating effect upon the body; but if the cold is severe, and the exposure to it long continued, while the heat is not maintained by warmth of clothing or exercise, the skin becomes pale, and the muscles become gradually stiff and contract with difficulty, especially those of the face and extremities. Sensibility is lost, a state of torpor ensues, followed by profound sleep, from which the person cannot be readily roused; in this state of lethargy the vital functions gradually cease, and the person finally perishes. Such are the general effects of intense cold upon the body; its influence on the nervous system is seen in the numbness, torpor, and sleepiness which have been described as consequences of a long exposure to severe cold. Giddiness, dimness of sight, tetanus, and paralysis have in some cases preceded the fatal insensibility. It has been found that temperature materially affects the amount of oxygen taken by the blood. At a low temperature this fluid takes less oxygen; hence it becomes less oxygenated, and this state of the blood affects the condition of the brain and nervous system. (Bernard, op. cit., p. 114.) It was observed during the retreat of the French from Moscow, that those who were most severely affected by cold often reeled about as if in a state of intoxication; they also complained of giddiness and indistinctness of vision, and sank under a feeling of lassitude into a state of lethargic stupor, from which it was found impossible to rouse them. Sometimes the nervous system was at once affected; tetanic convulsions, followed by rigidity of the whole of the voluntary muscles, seized the individual, and he rapidly fell a victim. Symptoms indicative of a disturbance of the functions of the brain and nervous system have also been experienced by Arctic travellers during their residence within the Polar circle. The researches of Pouchet on the effects of a freezing temperature on animals have led him to the conclusion that death is due to a physical change in the blood-globules, and not to any effect on the nervous system. The first phenomenon produced by cold is a contraction of the capillary vessels to such an extent that the blood-globules cannot enter them; these vessels, therefore, remain completely empty. The second phenomenon is an alteration of these globules, amounting to their complete disorganization. Under these circumstances an animal cannot be restored. ('Chem. News,' 1865, 2, p. 263.) A human being may, however, perish from a degree of cold not sufficient to produce congelation.

Circumstances which accelerate Death.—There are certain conditions which may accelerate death from cold. In all cases in which there is exhaustion of the nervous system, as in those who are worn out by disease or fatigue, in the aged and infirm, or, lastly, in persons who are addicted to the use of intoxicating liquors, the fatal effects of cold are more rapidly manifested than in others who are healthy and temperate. It has been uniformly remarked that, whenever the nervous energy is impaired, either by intoxication or exhaustion from fatigue, a man dies quickly from cold. The exposure of drunken persons during a severe winter may therefore suffice to destroy life, although the cold might not be so intense as to affect others who were temperate. Casualties of this nature sometimes occur during the winter season in the metropolis; and a knowledge of the influence of intoxication in accelerating death under such circumstances may occasionally serve to remove a doubt in the mind of a practitioner respecting the real cause. Infants, especially when newly born, easily perish from exposure to cold. Cold, when accompanied by rain and sleet, has a more powerfully depressing influence than when the air is dry—probably from the effects of evaporation. The following case, related by Currie, shows the fatal effects of exposure to cold winds accompanied with humidity: 'Of several persons who clung to a wreck, two sat on the only part that was not submerged; of the others, all were constantly immersed in the sea, and most of them up to the shoulders. Three only perished, two of whom were generally out of the sea, but frequently overwhelmed by the surge, and at other times exposed to heavy showers of sleet and snow, and to a high and piercing wind. Of these two, one died after four hours' exposure; the second died three hours later, although a strong healthy adult, and inured to cold and hardship; the third that perished was a weakly man. The remaining eleven, who had been more or less completely submerged, were taken from the wreck the next day, after twenty-three hours' exposure, and they recovered. The person among the whole who seemed to have suffered least was a negro; of the other survivors, several were by no means strong men, and most of them had been inured to the warm climate of Carolina.' The fatal action of extreme cold on animals has been examined by Crecchio. ('Ann. d'Hyg.,' 1868, t. 1, p. 436.)

Appearances after Death.—Opportunities rarely occur of examining bodies when death results purely from exposure to cold. The skin is commonly pallid, and the viscera of the chest and abdomen as well as the brain are congested with blood. Kellie found, in two cases which he examined, a redness of the small intestines from the congestion of the capillary vessels, and a great effusion into the ventricles of the brain. A sufficient number of cases have not yet been inspected to enable us to determine how far these two last-mentioned appearances are to be regarded as consequences of death from cold; but all observers have found a general congestion of the blood-vessels and viscera. In consequence of the great congestion uniformly met with in the vessels and sinuses of the brain, some pathologists have regarded death from cold as resulting from an attack of apoplexy; but the symptoms which precede death do not bear out this view. Effusions of blood have not yet been observed, and a mere fulness of the cerebral vessels after death is not in itself sufficient to justify this opinion. It will be observed that, on the whole, these appearances are remarkably similar to those which are found in death from severe burns and scalds. In a case which occurred to Hilty, a man, æt. 57, in a state of intoxication, died from exposure to cold during a severe winter's night. A minute description of the appearances is given, but the principal were—great congestion of blood in all the cavities of the heart and the large vessels, the blood fluid and of a dark crimson colour, a congested state of all the internal organs, especially of the liver and kidneys, numerous spots or patches of redness on the skin (frost-erythema), and the bladder distended with urine. ('Vierteljahrsschr. für Gerichtl. Med.,' 1865, 2, p. 140.) Thus, then, a medical jurist will perceive that, in order to come to a decision whether, on the discovery of a dead body, death has taken place from cold or not, is a task of some difficulty. The season of the year, the place and circumstances under which the body of the deceased is found, together with the absence of all other possible causes of death (such as from violent injuries or internal disease), form the only basis for a medical opinion. Death from cold is not to be determined except by negative or presumptive evidence; for there is no organic change, either externally or internally, sufficiently characteristic of it to enable a medical man to give a positive opinion on the subject.

Ogston, from an inspection of thirteen bodies of persons that had died from the effects of cold, considers that the following peculiar appearances afford, when present, a high probability as to the cause of death being cold:—1. An arterial hue of the blood generally, except when viewed in mass within the heart; the presence of this coloration not having been noted in two instances. 2. An unusual accumulation of arterial and venous blood on both sides of the heart, and in the larger blood-vessels of the chest. 3. Pallor of the general surface of the body, and anæmia of the viscera most largely supplied with blood. The only exceptions to this were moderate congestion of the brain in three of the cases, and of the liver in seven of them. 4. Irregular and diffused dusky-red patches on limited portions of the exterior of the bodies, encountered in non-dependent parts, these patches contrasting forcibly with the pallor of the skin and general surface. The above appearances were not, however, so universally met with in the children as in the adults.

HEAT.

Intense Heat. Heat-Apoplexy.—The effect of an intensely heated atmosphere in causing death has been but little studied. Some years since the author was consulted in one case in which the captain of a steam-vessel was charged with manslaughter, for causing a man to be lashed within a short distance of the stoke-hole of the furnace. The man died in a few hours, apparently from the effects of this exposure. The engine-rooms of steamers in the tropics have been observed to have a temperature as high as 140° F.; and engineers after a time become habituated to this excessive heat, without appearing to suffer materially in health. In certain manufactures the body appears to acquire a power, by habit, of resisting these high temperatures; still, it has been proved that many suffer severely. In a Report on the Employment of Children (1865), it is stated that in a glass-manufactory a thermometer held close to a boy's head stood at 130° F., and, as the inspector stood near to observe the instrument, his hat actually melted out of shape. Another boy had his hair singed by the heat, and said that his clothes were sometimes singed too; while a third worked in a temperature of no less than 150°. Amid this tremendous heat they carry on work which requires their constant attention: they are incessantly in motion. In the Turkish bath, higher temperatures than this are common, but there is reason to believe that serious symptoms have been occasionally produced in persons unaccustomed to them, and that in one or two cases death has resulted. All sudden changes from a low to a high temperature are liable to cause death in aged persons, or in those who are suffering from organic diseases. In attempting to breathe humid air heated to temperatures varying from 180° to 200° F., there is a sense of suffocation, a feeling of dizziness, and other symptoms indicative of an effect on the brain; and the circulation is enormously quickened.

In 1861, an inquest was held on the body of a stoker of an Aberdeen steamship. He had been by trade a grocer, and was not accustomed to excessive heat. While occupied before the engine-furnace, he was observed to fall suddenly on the floor in a state of insensibility; when carried on deck it was found that he was dead. All that was discovered on a post-mortem examination was an effusion of serum into the ventricles of the brain; death had been caused by sudden apoplexy. In some cases a person may sink from exhaustion as a result of long exposure. Intense heat appears generally to operate by inducing congestion of the brain (heat-apoplexy). It has now become one of the recognized causes of death in this country, in the Registrar-General's reports. In some cases a person may sink and die suddenly from exhaustion, or symptoms of cerebral disturbance may continue for some time, and the case ultimately prove fatal.

Death from sunstroke, when this is not immediately fatal, is preceded by some well-marked symptoms, such as weakness, giddiness, headache, disturbed vision, flushing of the face, followed by oppression and difficulty of breathing, and in some cases stupor passing into profound coma. The skin is dry and hot, and the heat of the body is much greater than natural. (‘Ann. d’Hyg.,’ 1867, t. 1, 423.) In one case, the patient, a boy, æt. 13, remained in a state of semi-consciousness for four days, and then had a cataleptic seizure. (‘Lancet,’ 1870, ii. p. 184.) Passauer has fully considered this subject in reference to armies in ‘Vierteljahrsschr. für Gerichtl. Med.,’ 1867, 1, p. 185. The symptoms in cases of sunstroke have not always been accurately recorded. In one instance, a medical man, who suffered from an attack while on a voyage in the tropics, was able to note and describe his symptoms from the commencement of the attack up to the eighth day, when he recovered. (See ‘Lancet,’ 1872, i. p. 464; also ii. p. 128.)

STARVATION.

A Rare Cause of Death.—Death from the mere privation of food is a rare event, although, if we were to form an opinion from the verdicts of coroners’ juries, its occurrence would not appear to be uncommon in our large cities. In one of the Annual Registration Returns it is stated that 130 persons had died from starvation. Such cases must, however, be received with some distrust, as care is rarely taken to ascertain precisely how far bodily disease may have been concerned in the fatal result. Still, it cannot be denied that starvation should be classed among the forms of violent death, being sometimes the result of criminal neglect or inattention in the treatment of children, lunatics, or of infirm and decrepit persons, and thus constituting homicide; or at other times, although rarely, arising from an obstinate determination to commit suicide in those from whom all other means of self-destruction are cut off.

Acute Starvation. Symptoms.—The symptoms which attend on the privation of food, or the supply of improper food, have been variously described. Referring to cases which occurred during the Irish famine of 1847, Donovan states that the persons who suffered described the pain of hunger as at first very acute, but said that after twenty-four hours had been passed without food, the pain subsided and was succeeded by a feeling of weakness and sinking, experienced principally in the region of the stomach; accompanied with insatiable thirst, a strong desire for cold water, and a distressing feeling of coldness over the entire surface of the body. In a short time, the face and limbs became frightfully emaciated; the eyes acquired a peculiar stare; the skin exhaled an offensive smell; and was covered with a brownish filthy-looking coating, almost as indelible as varnish. This he was at first inclined to regard as encrusted filth, but further experience convinced him that it was a morbid secretion poured out on the surface of the body. The sufferer tottered in walking like a drunken man; his voice was weak, like that of a person affected with cholera; he whined like a child, and burst into tears on the slightest occasion. In respect to the mental faculties, their prostration kept pace with the general wreck of bodily power; in many there was a state of imbecility, in some almost complete idiocy; but in no instance was there delirium or mania, which have been described as symptoms of protracted abstinence among shipwrecked mariners. ('Dub. Med. Press,' 1848, p. 67.)

In a case which fell under the notice of Sloan, a healthy man, æt. 65, was by an accident shut up in a coal-mine for twenty-three days without food. When found, he was conscious, and he recognized and named his deliverers. He was so weak that he could scarcely raise his hand to his mouth, and so much emaciated as to excite the surprise of his fellow-workmen by the extreme lightness of his body. Under careful treatment he so far recovered as to give an account of his feelings. For the first two days, hunger was his most urgent symptom. This passed off, and he then began to suffer from severe thirst, which he allayed by drinking some foul water. After *ten days* he became so weak that he was unable to move from the spot where he had lain down. He slept but little, and not soundly—never entirely losing the consciousness of his situation. His bowels acted only once, but he passed urine freely. The matter brought from his bowels after his rescue by injections, was dark-coloured, like meconium, and very fœtid. He died on the third day after his removal, in spite of every effort to save him, and on the day of his death he was in the following state: his features were sharp and pale, his eyes sunk; the skin of the abdomen seemed to touch the backbone, which could be distinctly felt through it; his body presented excessive emaciation; he had altogether a dried appearance, very much like that of natural mummies found in catacombs; his pulse was gone; his voice was in a whisper, like the *vox cholerica*; there was uneasiness, increased by pressure, in the region of the stomach; his intellect was sound, and remained so until death. ('Lond. Med. Gaz.,' vol. xvii. p. 265.) This case confirms the observation of Donovan, that delirium is not a necessary attendant on protracted abstinence; and it proves incontestably that a person may die from the effects of abstinence or starvation, in spite of the best-directed efforts for recovery. Thornhill reports the case of eight men and a boy who were shut in a coal-mine for eight days without food ('Lond. Med. Gaz.,' vol. xvii. p. 390); but the symptoms here noted were rather those of hunger than of long abstinence. They all suffered from excessive thirst; they were all troubled with ocular illusions, showing cerebral excitement. The occurrence of ocular spectra, and other symptoms indicative of a depressed state of the nervous system, have also been noticed by Casper.

Under art. *Abstinence*, 'Cyc. Pr. Med.,' Marshall Hall and Latham record their experience of the effects produced by the privation of food. In advanced cases they found among the symptoms headache, vertigo, delirium, disordered vision, restlessness, sleepless nights, convulsions, disorder of the intellectual faculties, and apoplexy. In the *Staunton* case (p. 505), the possible supervention of cerebral or nervous symptoms as a result of an insufficient supply of food was ignored by the medical men who conducted the defence, and symptoms most probably depending on inanition were referred by them to a special disease of the brain and its membranes.

Copland, in his 'Dictionary of Practical Medicine,' besides the symptoms above described, enumerates a depressed temperature, followed by insensibility, stupor, or coma, terminating in death. In all cases with extreme emaciation there is great muscular weakness. The person stands or moves with difficulty. They are the indications of extreme exhaustion.

According to Martin, the emaciation in starvation is characteristic; it is a withering or shrivelling up of the skin, which has lost its elasticity, giving to youth the aspect of age. Death, when not hastened by disease, is slow and imperceptible, or it is precipitated by syncope from sudden effort, or by exposure to severe cold. Delirium is not, according to him, a symptom of starvation. ('Med. Times and Gaz.,' 1861, i. p. 344.)

Period of Death.—The period which it requires for an individual to perish from hunger (acute starvation) is subject to variation; it will depend materially upon the fact whether the person has had it in his power or not to take at intervals a portion of liquid, to relieve the overpowering thirst which is commonly experienced. The smallest portion of liquid, thus taken occasionally, is found to be capable of prolonging life. It is probable that, in a healthy person, under perfect abstinence, death would not commonly take place in a shorter period than from a week to ten days. This opinion derives support from the results of those cases in which there has been perfect abstinence owing to disease in the throat and a difficulty of swallowing food. Age, sex, state of health, and the effects of exposure to cold, may accelerate or retard a fatal termination.

A well-marked instance of the tolerance of entire privation of food for the long period of *eleven days* occurred in 1878, on the Inman line of steamships. A young man, æt. 20, named James Donnelly, stowed himself away in one of the holds of the ship on the 23rd of Sept., the evening before the ship sailed from Liverpool. The ship arrived at New York on the 4th of Oct., and on lifting the hatches, Donnelly was found insensible beneath. During the entire passage he had had neither food nor drink. He found some salt below, of which he ate about two handfuls. He had with him an empty glass flask, from which he drank his urine each time that he voided it. He suffered from hunger only on the second day; after that he had intense thirst for four days. He then became insensible, and remembered nothing until he woke up in New York, on the evening of the Oct. 4. The muscles of his extremities did not appear to be much wasted, but his cheeks and abdomen were greatly retracted, and presented a livid appearance. He left the hospital perfectly recovered on Oct. 21.

Accidents to miners throw some light upon the power of endurance in the absence of food. In 1869, ten men and three boys were shut up in a coal-mine in Staffordshire, and remained for *eight* days without food and light. They were all saved excepting one, who died frantic. In 1877, several men and a boy, who met with a similar accident in South Wales, were rescued in an exhausted state also on the eighth day. These cases show that an adult can exist without food for a period of eight days, and by due precaution ultimately recover.

Casper believes that a period of from twelve to fourteen days is the limit for the survival of a strong healthy man entirely deprived of food. Casper's opinion receives some support from the case of a man, æt. 26. ('Lancet,' 1845, vol. i. p. 681.) The patient had been advised to abstain from food, and to take only water. For eleven days he acted on this advice, and tasted no kind of food, with the exception of a teaspoonful of beef-tea on the tenth day. He died on the twelfth day, having had for a few days a discharge of blood from the bowels.

The mode in which death takes place was accurately observed in the case of the Welsh fasting girl (p. 508). During the last hour she spoke nothing; she was too weak and too far gone. She was not sensible, but she appeared to be in a stupor like a dying person. In the case of *Harriet Staunton*, death took place under similar circumstances (p. 505).

Chronic Starvation.—When the person survives for some weeks, and the food supplied is insufficient in quantity or of bad quality, other symptoms show themselves. Among these there is pain in the region of the stomach, a suppression of the fæces, or, if discharged, they are in small quantity, dry, and dark-coloured; the urine is scanty, high-coloured and turbid; the intellect is dull. The person may be exhausted, and remain without motion in one position, or be seized with a furious delirium, which may drive him to acts of violence. In the last stage the body is reduced to an extreme state of emaciation, and before death it evolves an offensive odour, like that of incipient putrefaction. The excretions have also a putrescent odour. The surface of the skin may be covered with spots (petechiæ), and the person finally dies, in some cases slightly convulsed. Chossat found, in his experiments on animals, that in some instances the animal died after having had successive attacks of convulsions. (Beck's 'Med. Jurispr.,' vol. 2, p. 80.)

Appearances after Death.—There are but few details of the appearances presented by the bodies of those who have died from starvation, and the cases themselves are too rare to enable us to decide with certainty upon the accuracy of the reports which have hitherto appeared on the subject. The body is extremely shrunk and emaciated, and remarkable for its lightness. The skin is dry, shrivelled, and free from fat. The muscles are soft, deprived of fat, and much reduced in size. The stomach and intestines are usually found collapsed, contracted, and empty, the mucous membrane being thinned and sometimes ulcerated. The liver, lungs, heart, kidneys, and the great vessels connected with these organs are shrunk, collapsed, and destitute of blood; the heart and kidneys free from any surrounding fat—the gall-bladder distended with bile—the omentum shrunk and destitute of fat. One body was observed to be extremely emaciated. The intestines were collapsed, the stomach was distended with air, and slightly reddened at its greater extremity. The omentum had almost disappeared, and was entirely destitute of fat. The liver was small, and the gall-bladder distended with bile. The other viscera were in their normal state.

('Lond. Med. Gaz.,' vol. xvii. p. 389.) In another case, the face was much shrunk and emaciated; the eyes were open and presented a very red appearance, as intense as in a case of acute ophthalmia during life. This red appearance has also been met with by Donovan in death from exposure to cold. ('Dub. Med. Press,' 1848, p. 66.) The skin was tough, and there was scarcely any cellular membrane to be seen. The tongue, lips, and throat were dry and rough. A peculiar odour was exhaled from the body. The lungs were shrunk and contracted; the investing membrane was slightly inflamed. The stomach and intestines were empty, but quite healthy; the gall-bladder was nearly full of bile, and the surrounding parts were much tinged by this liquid. The urinary bladder was empty and contracted. ('Lancet,' March, 1838.)

In some cases inspected during the Irish famine, Donovan states that the appearances which he witnessed were extreme emaciation, total absorption of the fatty matter on the surface of the body, total disappearance of the omentum, and a peculiarly thin condition of the small intestines, which in such cases were so transparent that, when the deceased had taken any food immediately before death, the contents could be seen through the coats of the bowel: on one occasion he was able to recognize a portion of raw green cabbage in the duodenum of a man who had died from starvation. This thin condition of the coats of the intestines he looked upon as the strongest proof of death from (chronic) starvation. The gall-bladder was usually full, and the parts in the vicinity of it were much tinged by the cadaveric exudation of bile; the urinary bladder was generally contracted and empty, and the heart pale, soft, and flabby; there was no abnormal appearance in the brain or lungs. Martyn assigns, as a condition of the intestines diagnostic of starvation, that they are not only contracted, but shrunken and diminished in size, shortened in length as well as in calibre, and like a mere cord, as if the canal were obliterated. ('Med. Times and Gaz.,' 1861, i. p. 344.) He met with this state in three cases—once in starvation from want of food, and twice from total obstruction to its ingestion. Fletcher found the following appearances in the cases of two children who died from starvation—the elder aged one year and ten months, the younger four months. In the body of the elder there was extreme emaciation, without the slightest trace of disease in any of the viscera. Some dirty creamy fluid, and four cherry-stones, were found in the small intestines, but no distinctly fæcal matter, a few grains of which, however, were found in the large intestines: scarcely a trace of fat was visible. In the infant the same appearances were presented, although the emaciation had not proceeded to the same extent. ('Proc. of Liverpool Med. Soc.,' 1855–56.) In some alleged deaths by starvation, ulceration of the bowels is met with. This has been considered to arise from want of food; but Donovan did not meet with it in the bodies of those who died of lingering or *chronic* starvation. ('Dub. Med. Press,' 1848, p. 66; also 'Lancet,' 1845, i. p. 681; 1849, i. p. 180; 'Dub. Jour. Med. Sci.,' vol. iii. p. 273.) Copland describes among the appearances in the cases which he quotes, shrinking of the viscera, with increased vascularity of the brain and its membranes, with sometimes a limpid serous effusion between them. According to Osborne ('Dub. Jour.,' 1839, vol. xv. p. 423), in cases which prove fatal from long abstinence, chronic inflammation of the stomach is one of the appearances met with. He says that those who die of starvation usually die with the mucous membrane of the stomach and bowels in a state of inflammation, and generally of ulceration. Hence it may be presumed that long fasting is injurious by inducing a state of irritability, causing the membrane to pass very readily into an inflammatory condition. A congested state of the stomach is, therefore, consistent with death from starvation.

Death from Starvation or Disease.—The post-mortem appearances, in order to throw a light upon the cause of death, should be accompanied with an otherwise healthy state of the body; since, as is well known, some of them may be produced by organic disease, and death may really be due to disease and not to the privation of food. It will not be always easy to say whether the emaciation depends on disease or want of food, unless we are put in possession of a complete history of the case. On this account, in all charges of homicidal starvation, the defence generally turns upon the coexistence of disease in the body, and the sufficiency of this to account for death. As in most cases of death from protracted abstinence or privation of food, disease is likely to be set up, or, if already existing, to be aggravated by the want of proper nourishment, so it follows that in the bodies of persons who have died of starvation, traces of disease are generally found. The cause of death may here be contested, and the case often admits of a strong defence.

In no instance probably has this conflict of medical opinion been more strikingly shown than in what has been called the *Penge* case. (*Reg.* v. *Staunton and others*, C. C. C., Sept. 1877.) The deceased, *Harriet Staunton*, had been kept in close confinement by the accused, four in number, and, while in an almost moribund state, she had been suddenly removed by them to Penge, where she died, in a state of complete exhaustion, on the day following her removal. She was seen a few hours before her death by a medical man: she was then insensible, and in a state of complete collapse.

As the only persons about the deceased were the four accused and a servant-girl, a relative of two of the prisoners, it was difficult to procure any trustworthy account of the symptoms preceding her removal and death. Such as they were, they substantially corroborated the conclusions drawn from a post-mortem examination of the body. The body was examined by Wilkinson, Bright, Harman, and three other surgeons. The appearances which they found were—the body greatly emaciated; the skin parchment-like, dry, and shrivelled; the muscles shrunk and entirely destitute of fat; the breasts almost imperceptible; the body covered with vermin. The entire weight was only seventy-four pounds, while in a healthy adult of the same age it would be about a hundred and twenty pounds. The stomach was small and so much thinned that the undigested food in it was distinctly visible through its coats. The intestines were pale, shrunken, and empty; they contained no food or fæcal matter. When held up to the light, the wasting of the coats was well marked. The omentum was scarcely visible and quite destitute of fat, of which there was, indeed, a total absence in every part of the body. The organs of the chest and abdomen were shrunken, and smaller than usual. They were generally in a healthy condition. The only appearances of disease in the body were: 1. A slight tubercular deposit at the apex of the left lung. 2. A congested appearance of the cardiac extremity of the stomach, as well as of the duodenum. 3. There were two small patches of miliary tubercular deposit (*recent*) upon the arachnoid membrane on the upper surface of the left hemisphere of the brain. There was no deposit on the pia mater or on the base of the brain, and the arachnoid and pia mater were not adherent. There was no trace of meningitis, *i.e.* inflammation of the membranes of the brain, either simple or tubercular. There was no effusion, softening, or disease of the brain. From these appearances the medical men who examined the body drew two conclusions: 1. That there was no disease in the body sufficient to cause death, or to account for the extreme emaciation and exhaustion. 2. Considering that the appearances included all those which the best authorities assigned to death by starvation, it was their unanimous opinion that the cause of death in the deceased, Harriet Staunton, was starvation and neglect, understanding by this an insufficient supply of proper food. The general evidence given at the trial satisfied the jury that there had been, on the part of the accused, intentional and deliberate neglect, and they returned a verdict of wilful murder.

For the defence, it was urged that the emaciation and other symptoms of starvation were due to disease—*i.e.* to tubercular meningitis, and not to the privation of food or the supply of insufficient food. If there was any truth in this theory, it followed that a grave mistake had been made in charging the accused with any crime. This defence was set up by three medical men who had not had an opportunity of seeing the body, or even of consulting with those who had made the inspection. In accordance with public opinion, the capital sentence was commuted to penal servitude for life against three of the accused; while the fourth, Alice Rhodes, against whom the evidence of complicity and motive was weak, was discharged.

Looking at all the medical facts of this remarkable case, the author saw no reason to doubt that the deceased died from starvation, as the result of an insufficient supply of food. He thought there was no proof whatever that the diseased appearances met with in the body had reached a stage sufficient to account for death, irrespective of starvation and neglect. No medical man had been called in to see the deceased during her long confinement. Her mother and all her relatives had been studiously prevented from visiting her. She was, in fact, for many weeks completely isolated from the world by the accused persons; and within the last twenty-four hours of her life, while in an exhausted and prostrate condition, she was hurriedly removed in an open vehicle and by rail a distance of more than twenty miles. The only motive which could be suggested for this violent proceeding was that the accused persons might thus be enabled, as death was imminent, to procure a certificate of death from a medical man not acquainted with the facts. They succeeded in procuring a certificate of death from apoplexy; but the medical man who signed it had so much doubt, that on hearing something of the previous history of the case, he gave information to the coroner.

It has been complained that, on this occasion, an undue importance was attached by the witnesses for the defence to the presence of a miliary tubercular deposit, about half an inch in diameter, on the arachnoid membrane of the brain. The witnesses for the prosecution, who saw it agreed that it was recent, and quite insufficient to account for the extreme emaciation or death of the woman. One witness for the defence so far agreed with them as to say that he had never known such an amount of emaciation as was here described to take place from such a cause within so short a time.

In all cases of death from alleged starvation, but especially in those where a charge of murder is raised, a medical man or expert is bound to give full effect to the presence of disease, its extent and its adequacy to cause appearances such as are found on the body. All the medical witnesses for the prosecution agreed that there was no meningitis (inflammation of the membranes of the brain), nor any of the products of inflammation. As this statement was made by them from actual observation, any expert subsequently dealing with the case was bound to accept and act upon it, or to reject the evidence altogether. In place of this, however, and in the absence of any inspection of the brain, they affirmed that meningitis was present, and that the woman died of it in a tubercular form. In a summary of the case in its pathological aspects by Virchow ('Med. Exam.,' Nov. 1877, p. 882), he states that he should not consider himself justified in regarding a deposit of tubercle such as that described as of fatal significance, at least in a case (like this) where such deposit had its seat upon the convex surface of the left cerebral hemisphere. The jury at the trial, and the authorities to whom an appeal was subsequently made, rejected this theory of the cause of death. If this mode of dealing with medical evidence and medical facts were generally followed, it would be scarcely possible to obtain a conviction in any case of actual homicidal starvation.

The editor is of opinion that Harriet Staunton's death was accelerated by the cruel and neglectful treatment to which she—a tubercular woman—was subjected; but that there was not sufficient evidence that her death was due to sheer starvation.

Voluntary Starvation. Pretending Fasting.—There are a few cases recorded in which persons have voluntarily abstained from food, liquid or solid, for the purpose of self-destruction. Suicide, as a result of perfect abstinence, is, however, exceedingly rare; the person cannot resist the intolerable thirst, or the desire for food, when placed within his reach. It has been sometimes observed among the insane. As it requires a period of about *ten days* for the destruction of life under these circumstances, *i.e.* in the *acute* form of starvation, the resolution to abstain can be rarely maintained, and for the purpose of self-destruction starvation would never be resorted to, except when all other means of destroying life were removed.

Pretended fasting has been a subject of imposture at various times. The case of *Sarah Jacobs*, the *Welsh Fasting Girl*, shows how it may be certainly detected by strict watching. This girl, æt. 13, was stated to have voluntarily abstained from any kind of food for a period of *two years*. She had kept her bed during that time—lying in it decorated as a bride, visited by hundreds of persons—in fact, she was thus publicly exhibited by her parents as a girl of miraculous powers. Her lips were moistened with water once a fortnight, but according to the parents, no food was given to her. Four professional nurses from Guy's Hospital were set to watch the girl, and the result was that, after passing through the usual stages of actual starvation, she died on the ninth day. She refused to take food at any time during the strict watching, and voluntarily accepted a lingering death rather than reveal the imposture. Her parents and those around her allowed her to die. A post-mortem examination presented the following appearances: The body was plump and well-formed; the membranes of the brain were much injected, the brain itself was healthy and of proper consistency. There was a layer of fat from half an inch to an inch thick beneath the skin of the chest and abdomen. The contents of the chest were healthy. The stomach contained three teaspoonfuls of a semi-gelatinous substance of the consistency of syrup, having a slightly acid reaction. The small intestines were empty, and presented no attenuation or thinning of the coats. In the colon and rectum there was half a pound of solid excrement in a hardened state, which might have been there, according to the medical witness, a fortnight or longer. The liver was healthy, and the gall-bladder was greatly distended with bile; the kidneys and spleen were healthy, and the urinary bladder was empty.

The medical evidence was to the effect that the child had died from exhaustion as the result of starvation. The parents were tried on a charge of manslaughter. (*Reg.* v. *Jacobs and wife*, Carmarthen Sum. Ass., 1870.) An attempt was made in the defence to refer death to shock, and not to the want of food. The medical facts relied upon in support of this theory were the presence of fat in the body, and the absence of any thinning of the coats of the intestines; but as Fowler very properly pointed out ('Lancet,' 1870, ii. p. 150), the absence of fat and the thinning of the intestines are only likely to be met with after long or *chronic* fasting, when the person has survived many weeks on insufficient or innutritious food. In the case of this girl, the only proved abstinence from food was during the last eight days of her life, when she was thoroughly watched, and this period of time would not suffice for the entire removal of the fat and the thinning of the coats of the intestines. The prisoners were convicted of causing the death of their child by criminal negligence. ('Lancet,' 1872, ii. p. 132.)

In 1880, *Dr. Tanner*, an American physician, entered upon, and is said to have successfully accomplished, a forty days' fast. It is doubtful whether this was a great imposture, or a remarkable feat of foolhardy endurance. The conditions under which he was watched were by no means satisfactory. Water was taken, at times freely; and at one time it was said that he increased his weight upon a water dietary. ('Brit. Med. Jour.,' 1880, ii. p. 215.) No complete medical history of this case has been published. Tanner is said to have had several imitators.

PREGNANCY.

CHAPTER 44.

SIGNS OF PREGNANCY.—SUPPRESSION OF THE MENSES.—QUICKENING.—SOUNDS OF THE FŒTAL HEART.—FEIGNED PREGNANCY.—CONCEALED PREGNANCY.—PREGNANCY IN THE DEAD.—IMPREGNATION IN A STATE OF UNCONSCIOUSNESS.—LEGAL RELATIONS.

Signs of Pregnancy.

Suppression of the Menses.—It is well known that, in the greater number of healthy women, so soon as conception has taken place, this secretion is arrested. But there are certain abnormal conditions which must not be overlooked. There are some cases recorded which show that women in whom the menses have never appeared may become pregnant. This, however, is allowed by all accoucheurs to be rare; and, when it occurs, which we may readily learn from the account of the woman, it will be necessary to search for other signs in order to determine the fact of pregnancy. Irregularity as to the period at which the function takes place is common among females. This irregularity may depend upon the age of the person, or upon disease, either of which causes it will not be difficult to recognize. The continuance of the menses after conception may make a pregnancy appear short. A case is reported in which a woman was married in the summer of 1856, and the menses continued after as before marriage. In Oct. 1857, they ceased for the first time, and in the following December the woman was delivered of a full-grown child: as the abdomen was not much enlarged, she thought that she was only two months pregnant. ('New York Jour.,' 1859, p. 286.)

There are numerous disorders of the womb under which, irrespective of pregnancy, the menses may become suppressed. The continuance of the menstrual discharge, when once set up, is not a necessary condition for impregnation. Murphy has reported the case of a woman who for sixteen years went on bearing children, eight in number, without having had during that period any appearance of the menses. Reid, who quotes this case, mentions five instances that fell within his own knowledge in which females became pregnant notwithstanding a long previous cessation of the discharge. ('Lancet,' 1853, ii. p. 236.) The absence of the menses as a consequence of pregnancy is generally indicated by the good health which a female enjoys; and although disease may coincide with pregnancy, yet a careful practitioner will be able to estimate from the general symptoms the probable cause to which the suppression is due. On the other hand, a discharge analogous to the menstrual sometimes manifests itself, not merely for several periods in a pregnant woman, but during the whole course of pregnancy. (Murphy's 'Obst. Rep.,' 1844, p. 9; also Henke's 'Zietschrift der S. A.,' 1844, p. 265. See 'Ann. d'Hyg.,' 1873, t. 2, p. 140.) Whitehead has collected seven well-marked instances of menstruation during pregnancy. ('On Abortion,' p. 218.) These facts show that we should be cautious in forming an opinion; we must not assert that, because a discharge continues, pregnancy cannot possibly exist, or, because there is no discharge, a female must be pregnant. The retention of the menses within the womb from any cause may produce enlargement of the abdomen, and give rise to some of the external symptoms of pregnancy.

Feigned Menstruation.—The menses may be either suppressed or retained; but if there be any strong motive for the concealment of her condition, a woman may feign menstruation. Montgomery detected a case of this kind, by the examination of the areolæ of the breasts. The woman had stained her linen with blood in order to make it appear that the menses continued, but she subsequently admitted that this was an imposition. There are no certain means of distinguishing between menstrual and ordinary mammalian blood.

Prominence of the Abdomen.—A gradual and progressive enlargement of the abdomen is a well-marked character of pregnancy; the skin becomes stretched, and the navel almost obliterated. This enlargement in general begins to be obvious about the third month, although there are some women in whom the enlargement may not become perceptible until the fifth or sixth month, or even later; still, it may be detected on examination. In fact, this sign can never be absent in pregnancy, although it may not be so apparent in some women as it is in others. The objection which exists to it is that numerous morbid causes may give rise to prominence of the abdomen. This is undoubtedly the fact, as we have occasion to witness in the various kinds of dropsy, or in suppressed and retained menses—diseases which, in several instances, have been mistaken for pregnancy by eminent practitioners. On the other hand, instances are not wanting, in which, owing to the persistence of menstruation, and the absence of quickening, the gravid womb has been actually tapped by mistake for an ovarian tumour: the operation being speedily followed by the birth of a child (Whitehead 'On Abortion,' p. 186); but the history of a case will in general enable a practitioner to form a correct opinion. ('Ann. d'Hyg.,' 1873, t. 2, pp. 142 and 144.)

A Change in the Breasts.—These organs in a pregnant woman are full and prominent, and the areolæ around the nipples undergo changes of colour which Montgomery and others regard as highly characteristic of the pregnant state. A mere fulness or pain in the breasts, and even in some rare instances the secretion of milk, may arise from other causes than pregnancy. Severe uterine or ovarian irritation or disease may cause the breasts to become painful, swollen, and secrete milk. The fulness of the breasts from pregnancy is not commonly observable until about the second or third month. A more or less transparent fluid is secreted by the gland-tissue of the breast, and can be expressed from the nipples. Such cases, however, are not very common; but after a woman has once secreted milk, the secretion may be reproduced in the breasts by very slight causes, quite independently of pregnancy.

The *areola* is generally observed during pregnancy to become considerably darker in colour and larger in diameter. The skin of which the areola is formed is soft, moist, and slightly tumid. The little glandular follicles about it are prominent, and often bedewed with a secretion: the change of *colour* has been chiefly attended to. The areolæ are commonly well marked in from the second to the fourth month of pregnancy—the intensity of colour being the last condition of the areola to appear. The prominence of the glandular follicles does not always exist in pregnancy, and the areola may become large and dark-coloured from other causes: consequently, these signs are only to be looked upon as corroborative. In females of dark complexion, the areolæ are naturally dark irrespective of pregnancy; and in some advanced cases these changes in the areolæ are entirely absent. ('Edin. Month. Jour.,' March, 1848, p. 693.) Montgomery has described as a sign of pregnancy the existence of a *brown line* extending from the pubes to the navel, especially in women of dark complexion, and a dark-coloured but not raised areola of about a quarter of an inch in breadth around the navel; but this also may be produced by uterine or ovarian disease.

Quickening.—The signs above given are applicable to the early as well as to the late stages of utero-gestation; but that which we have here to consider is one which is rarely manifested until about the fourth or fifth month. Quickening is the name applied to peculiar sensations experienced by a woman about this stage of pregnancy. The symptoms are popularly ascribed to the first perception of the movements of the fœtus, which occur when the womb begins to rise out of the pelvis; and to these movements as well as probably to a change of position in the womb, the sensation is perhaps really due. The movements of the fœtus are perceptible to the mother before they are made evident by an external examination. The term is derived from the old Saxon word 'quick,' signifying living; as, at the time when medical science was in its infancy, it was considered that the fœtus only received vitality when the mother experienced the sensation of its motion. On the occurrence of quickening there is generally a great disturbance of the system, indicated by syncope, nausea, and other distressing symptoms. After a short time the woman recovers; and, if sickness has hitherto attended the pregnant state, it has been frequently observed to disappear when the period of quickening has passed.

No evidence but that of the woman herself can satisfactorily establish the fact of quickening, and this it is necessary to bear in mind; since, in some cases in which pregnancy is an object of medico-legal importance, proof of quickening may be demanded by law. Reid remarks ('Lancet,' 1853, ii. p. 237), with respect to this sign, that few women can tell the exact day on which they first feel it; and a large proportion cannot place it within a range of fourteen days, which is of little assistance in the calculation of the probable date of delivery. Women who profess to be most exact in noting the period of quickening differ from each other as to the time. There is much self-deception as to this symptom. The discovery of the movements of a child by an examiner is really a proof that the usual period of quickening is past, but their non-discovery at the time of examination is no proof whatever that the woman has not quickened; since the movements are by no means constant, and may be accidentally suspended even at several successive examinations. Besides, cases occur in which well-formed healthy women do not experience the sensation of quickening during the whole course of pregnancy; and, what is of more importance, the movements of the child may be at no time perceptible to the examiner. The uncertainty of quickening as a sign of pregnancy is too well known to require more than adverting to. Women have been known to mistake other sensations for it, and in the end it has been proved that they were not pregnant. A woman may declare that she has felt quickening when she has not; and unless the movements of the child are perceived by the examiner at the time, how is he to confirm or disprove her statement? Quickening, then (so far as it concerns the statement of the woman), cannot be relied on as a proof of pregnancy; but if the movements of a child can be felt by the examiner through the abdomen, this is clear evidence, not only of the woman being pregnant, but of her having passed the period of quickening. According to the general experience of accoucheurs, quickening takes place from the tenth to the twenty-fifth week of pregnancy; but the greater number of instances occur between the *twelfth* and *sixteenth* week, or between the fourteenth and eighteenth week after the last menstruation.

From these observations, it will be seen that an examiner may sometimes detect the *movements of the child* about the third or fourth month, at others not until the fifth or sixth, and in other instances not at all throughout pregnancy. Ahlfeld found that in forty-three cases in which the day of its occurrence was noted, it ranged from 108 to 134 days—the average being 132·7 days. ('Amer. Jour. Med. Sci.,' Oct. 1870, p. 567.) Even in those cases in which the movements of the child have indisputably existed, they are not at all times to be perceived; hence several examinations should be resorted to, before any opinion can be fairly expressed from their absence. The best mode of examining the abdomen for fœtal movements is to allow the hand to remain at rest on the abdomen. If the patient has quickened recently, the impulse is slight, and generally at only one spot, which, however, is seldom the same. Should she have advanced further, then the movements will be more rolling, and the parts of the child be detected at the same time. In making these examinations, a diagnosis may be facilitated by previously immersing the hand in cold water and then suddenly applying it to the abdomen. When the movements of the child are distinctly perceived through the skin of the abdomen, they constitute a certain sign of pregnancy; but their non-discovery at a particular time is no proof that a female is not pregnant. The jury of matrons probably trusted to this sign; hence their verdicts commonly turned out to be erroneous. There is another source of fallacy which may present itself when an artful woman is desirous of making it appear that she is pregnant—namely, that a woman may simulate the movements of a child by a peculiar action of the abdominal muscles. Medical practitioners of repute have been deceived for a time by this artifice, but this occurred before the discovery of chloroform and the stethoscope.

Sounds of the Fœtal Heart.—Another sign is that which is derived from *auscultation.* By the application of the ear or a stethoscope to the abdomen, at or about the fifth month of pregnancy (rarely earlier), the pulsations of the fœtal heart may be recognized and counted. These pulsations are not synchronous with those in the arteries of the mother: they are much more rapid, and thus it is impossible to mistake them. Their frequency, according to Hope, is in an inverse ratio to the stage of gestation, being 160 at the fifth, and 120 at the ninth month. Sometimes, however, the fœtal pulse may descend to 80 or even 60 beats in a minute. This sign, when present (like the fœtal movements), not only establishes the fact of pregnancy beyond all dispute, but shows that the child is living. The sound of the fœtal heart is, however, not always perceptible: when the child is dead, of course it will not be met with; but its absence is no proof of the death of the child, because the hearing of the pulsations by an examiner will depend very much upon the position of the child's body, the quantity of liquor amnii, the presence of disease, and other circumstances. Thus the sounds may be distinctly heard at one time and not at another; they may be absent for a week or fortnight, and then will reappear; so that, although their presence affords positive evidence, their absence furnishes uncertain negative evidence; and several examinations should be made, in the latter case, before an opinion is formed. The earliest time at which the pulsations may be heard has been stated to be about the fourth month; but they will be best heard after the sixth month. The reason why the sounds of the fœtal heart are not always perceived is owing, not only to changes in the position of the child, but to the vibrations having to traverse the liquor amnii and the soft layers of the skin of the abdomen. The presence of much fat in these layers intercepts them. The point where the sounds can be most readily perceived is in the centre of a line drawn from the navel to the anterior inferior spinous process of the ilium on either side—perhaps most commonly on the right. When clearly detected, they furnish an unequivocal sign of the pregnant state. Besides the sounds of the fœtal heart, there are other sounds to which the name of 'placental murmur' or *uterine sounds*, has been given. These are heard from an earlier date, *i.e.* at any time after the third month. As they may occur in connection with fibroid tumours of the womb, they do not necessarily indicate pregnancy. (Druitt, 'Med. Times and Gaz.,' 1860, i. p. 57.)

In reference to these signs of the pregnant state it may be observed that, if the motions of the child or sounds of the heart be perceptible, no other evidence of pregnancy need be sought for. The mere suppression of the menses, prominence of the abdomen, and fulness of the breasts cannot alone establish the fact; but unless the morbid causes of these abnormal states of the system be clearly and satisfactorily obvious to the examiner, it is a fair presumption from these symptoms that the woman is pregnant. In any case in which a doubt exists we should require sufficient time to form a correct opinion.

Changes in the Mouth and Neck of the Womb.—The signs hitherto mentioned are chiefly relied on in medical practice; but it must be remembered that no case can occur in civil or criminal jurisprudence in which it will not be in the power of a medical witness to make an examination of the woman. He may then form a safe judgment from the changes which take place in the neck of the womb, and from the sensation imparted to the finger by the presence of a rounded body (like the fœtus) floating in a liquid, when an impulse is given to the womb from below. Up to the fifth or sixth month of pregnancy, the neck of the womb, of its usual length, hard and firm, may be commonly felt projecting into the vagina. After that period, the womb rises into the pelvis, and the neck is spread out, and is shorter and softer, the aperture increasing in size and becoming rounder. Towards the end of gestation, the neck of the womb appears to be lost, becoming like a thin membrane, and sometimes no aperture can be felt.

A well-marked test of pregnancy is the motion perceptible to the finger on giving a sudden impulse to the child through the neck of the womb. Capuron calls this the touchstone in the distinction of the pregnant state; and, without it, he considers a medical jurist may be easily deceived. To this passive motion of a child, the name of *ballottement* is given. It cannot be easily determined before the fifth or sixth month; but after the latter period, especially as pregnancy becomes advanced, it is always available. In the French schools, the method of applying the *toucher* and *ballottement* to pregnant females is systematically taught, and by a little practice it may be easily acquired. This motion to the child can also be given through the abdomen, by external *ballottement*, in two ways; either by the patient lying on her side, the hand placed on the most depending part of the womb, or by placing the patient on her elbows and knees; the womb will then fall forwards, the child also will fall in contact with the front wall of the womb, and its presence thus be made more perceptible. This latter mode is best adapted for the early stages of pregnancy.

If we find amenorrhœa, or suppressed menses, and a tumour distended to a size consistent with the duration of the amenorrhœa—if the tumour be more or less central, alternately relaxing and contracting, containing an irregularly shaped body, which is freely moved within, and also self-moving,—we have clear indications of a living fœtus; and if we add to these the fœtal heart-sounds, with the other minor symptoms, we have a condition which, if clearly made out, must be considered complete proof of pregnancy. Of course, we may have certainty with the fœtal heart-sounds and movements if well marked, and a strong suspicion from the other symptoms.

As most of these signs refer to an advanced stage, a witness may be asked—What are the unequivocal indications of pregnancy *before the fifth and sixth months?* The answer to this question is of little moment to a medical jurist, since he is rarely required to give an opinion under these circumstances. In all *juridical* cases, when pregnancy is alleged or suspected, it is the practice for a judge or magistrate, on a representation being made by a medical witness, to postpone the decision one, two, or three months, according to the time required for obtaining *certain evidence.* This evidence will consist in plainly distinguishing (1) a rounded body floating freely in a tumour, which alternately relaxes and contracts; (2) the movements of a fœtus; and (3) the sounds of the fœtal heart. The most experienced men agree that before the *sixth month* the changes in the neck and mouth of the womb are of themselves too uncertain to enable an examiner to form a safe opinion; and, *à fortiori*, it is impossible to trust to external signs alone. Whitehead dissents from this view, and considers that a specular examination of the mouth of the womb is not only more satisfactory than any other mode of exploration, but that it will enable a person to determine with certainty the existence of pregnancy during its earlier stages—from a few days after conception to the middle or end of the fourth month, when auscultation first becomes available. In the *fourth week* the lips of the mouth of the womb at the centre of their margins are permanently separated to the extent of one or two lines; and the os tincæ (the aperture) itself, which was before a mere chink with parallel boundaries, forms an elliptical or sometimes rounded aperture, which is occupied by a deposit of transparent gelatinous mucus. At *six* or *eight* weeks it is decidedly oval, or irregularly circular, with a puckered or indented boundary having a relaxed and lobulated character. The whole circumference of its neck is enlarged, and the commissures or angles of the mouth are obliterated. The mouth continues of this irregular form throughout the whole period of gestation; but from the time of quickening to the end of the seventh month, the progressive changes are not so marked as to form a guide for determining the period of pregnancy. ('On Abortion,' p. 204.) This condition of the mouth of the womb must not be confounded with its menstrual state in the early stages, nor with a diseased state in the latter stage of gestation.

Feigned Pregnancy.—Pregnancy has been sometimes feigned or simulated for the purpose of extorting charity, of obtaining a settlement in a parish, or of compelling marriage; but it is scarcely necessary to observe that an impostor may be easily detected by a well-informed practitioner, since a woman always feigns an advanced stage of pregnancy. It is more easy to prove in most cases that a woman is not pregnant than that she is. ('Ann. d'Hyg.,' 1873, t. 2, p. 145.) Although she may state that she has some of the symptoms depending upon pregnancy (and, unless she has already borne children, she will not be able to sustain a cross-examination even respecting these), yet it is not possible for her to simulate, without detection, a distension of the abdomen or the state of the breasts. If she submits to an examination, the imposition must be detected; if she refuses, the inference will be that she is an impostor. Women have been known to possess the power of giving apparent prominence to the abdomen, and even of simulating the movements of a child by the aid of the abdominal muscles. By placing them under the influence of chloroform, the abdomen at once collapses, and the imposture is detected. These cases of spurious or feigned pregnancy are sometimes met with in hysterical females. (Simpson, 'Edin. Month. Jour.,' 1854, ix. 473; 'Lancet,' 1855, i. pp. 381, 429, 533.) Pregnancy may be feigned by a woman in order to escape the punishment of hard labour, to which she may have been sentenced. If in this case the slightest doubt should exist whether the woman is really pregnant or not, a restricted affirmative opinion should be given, since great and even irreparable mischief might result by taking an opposite course.

In civil cases of feigned pregnancy, an examination should always be made before giving an opinion, or the reputation of a medical man may suffer by his forming a hasty conclusion on the subject from insufficient data. In this respect the case of *Devonald* v. *Hope* (Q. B., Dec. 1838) is of some interest. A medical man having given an opinion that a female patient was pregnant, subsequently brought an action against her for medical attendance. It turned out, however, that she was not pregnant, and that there were no satisfactory medical grounds upon which his opinion was based. The plaintiff complained of having been deceived by the defendant as to her condition; but it is obviously in the power of any medical man to prevent such a deception being practised on him. An external examination only will not suffice either to affirm or negative the allegation of pregnancy, except when it is stated to be far advanced. (For a singular case in which, on a charge of assault, evidence of this kind was tendered, see 'Lond. Med. Gaz.,' vol. xxxvi. pp. 1083, 1169. On the fallacy of the signs of pregnancy, and the simulation of this state, see papers by Tardieu and others, 'Ann. d'Hyg.,' 1845, t. 2, 429; 1846, t. 1, 83; also 1873, t. 2, p. 145.)

Concealed Pregnancy.—By the law of Scotland, if a woman conceals her pregnancy during the whole period thereof, and if the child of which she was pregnant be found dead, or is amissing, she is guilty of an offence, and is liable to prosecution. Evidence is sometimes given as to outward appearances indicative of pregnancy; but the main proof of a woman having been pregnant, and that which is relied on for conviction, is clear and distinct evidence of the actual delivery of a child. This is generally furnished by medical witnesses. The Scotch law, by making the concealment of pregnancy under the circumstances above mentioned, an offence, proceeds on the principle that every pregnant woman is bound to make preparations for the safe delivery of a child; and it is therefore assumed that if a child be born clandestinely without preparation, and is found dead or is amissing, its death is owing to the want of such preparation. The English law imposes no obligation to make a pregnancy known.

Impregnation in a State of Unconsciousness.—It was formerly a question whether a woman could become *pregnant* without her knowledge. This may undoubtedly happen, when intercourse has taken place during profound sleep (lethargy), or when a woman has been thrown into this state by narcotic drugs or vapours. But it is difficult to admit that any woman should remain pregnant up to the time of her delivery, without being conscious of her condition, if the intercourse took place during the waking state. A woman endowed with ordinary intellect could not avoid *suspecting* her condition after the fourth or fifth month; and this alone would be sufficient to induce her to seek advice whereby the fact would become known to her. When a woman is impregnated in a lethargic state, it is unlikely that she should go beyond the sixth month without being fully aware of her pregnancy; and if her motives were innocent, she would undoubtedly make some communication to her friends. Capuron mentions a case of this kind, in which the fact of pregnancy was first ascertained at the end of the fourth month, by the woman having complained to one of her sisters of a strange sensation which she experienced in the lower part of her abdomen. ('Méd. Lég. des Accouchemens,' p. 86.) A young woman who had had intercourse knowingly was supposed not to have been aware of her pregnancy until the seventh month; but there is reason to believe that this woman was guilty of deception. ('Lond. Med. Gaz.,' vol. xxxix. p. 212.) There are generally, in these cases, strong motives for falsehood; hence such stories require close investigation before they are allowed to influence the opinion of a practitioner. A case occurred in 1857, in which a woman, æt. 22, described as modest and decorous in her behaviour, then advanced to the sixth month of pregnancy, asserted that she had not consciously had connection with any one, although she specified a date at which she remembered she had lost her consciousness—at which date intercourse might have been had. On being questioned, she denied that she had had at any time any soreness or pain in her private parts. Although there may be unconscious intercourse followed by pregnancy, it is not probable that in the case of a virgin there should be such intercourse without the production of pain, soreness, or laceration; and these symptoms, if not perceived at the time, should be felt subsequently and create a suspicion, if not an actual knowledge, of what had happened. This rendered the account which the woman gave wholly improbable. The fact that she was able to fix a date for her unconsciousness, with an accuracy in accordance with her condition, was also a suspicious circumstance.

Unconscious Pregnancy.—It is quite possible that women who are living in connubial intercourse may become pregnant without being conscious of it. Rüttel mentions the case of a woman, æt. 41, who had been married upwards of sixteen years, and who, while returning from a neighbouring village, was suddenly delivered of her first child, when only a few days before she had been complaining that she was not likely to have any children. The child was born living and mature. (Henke, 'Zeitschrift der S. A.,' 1844, p. 264.) Long met with a case in which a married woman, æt. 24, subject to irregular menstruation, consulted him for an attack of spasms. On his arrival, he found that she had suddenly given birth to a seven-months' child. Neither her husband nor herself had the slightest idea that she was pregnant. She had noticed that she had become somewhat stout, and that her breasts were more full than natural. She attributed her condition to improved health, and the cessation of the menstrual discharge was set down to some accidental cause. ('Med. Times and Gaz.,' 1857, i. p. 592. See also a case at full term by Tanner, 'Obst. Trans.,' vol. 4, p. 113.) A married lady, who had not had a child for a period of nineteen years, found herself, as she thought, getting unusually stout. She was moving about with her family to different places. At last her size alarmed her, and she thought she was suffering from dropsy: she consulted a physician, who informed her that she was in an advanced state of pregnancy. She treated this opinion with great contempt. In travelling with her daughter, they arrived at a miserable inn; on the night of their arrival, this lady was seized with the pains of labour, and was delivered of a child. She had made no preparation for the birth, and, up to the moment when she was seized with labour-pains, she had not, with all her former experience, the slightest idea that she was pregnant. (For other cases in which married women have had no consciousness of pregnancy, see 'Lancet,' 1860, i. pp. 609, 643.) Instances of this kind are important in reference to alleged unconscious delivery in women charged with infanticide. At the same time, all cases in which there are motives for pleading unconscious intercourse or pregnancy require close examination: they will frequently be found to be quite unworthy of belief. This remark especially applies to unmarried women who often consult a medical man on their condition with a full knowledge that they have exposed themselves to the chances of pregnancy. Up to the time at which the fœtal movements are perceptible, a woman may honestly attribute her condition to other causes. Dating from the middle period of pregnancy, however, she must be aware of her state, but she endeavours to dissemble this even to herself.

Pregnancy in the Dead.—There is no special case in law wherein the *fact of pregnancy* requires to be verified after the death of a woman; but an examination may be necessary in order to determine the identity of a body, or to rescue the reputation of the deceased from a charge of unchastity. The discovery of an embryo or fœtus with its membranes in the womb, would of course at once solve the question when the necessity for an examination occurred; and the practitioner will remember that, even supposing many years to have elapsed since interment, and the body to have been reduced to a skeleton, still if the fœtus had reached the period at which ossification takes place, traces of its bones will be found amidst the bones of the woman. The common practice of placing the body of a still-born fœtus in the coffin of a woman to whom the fœtus bears no relation must, however, be borne in mind. It is possible, too, that, where a child is buried with the body of a female, the bones of the two may become intermingled in the course of time. In examining the body of a woman long after death, for the purpose of determining whether she was or was not pregnant at the time of death, it may be proper to bear in mind that the unimpregnated womb undergoes decomposition much more slowly than other soft organs. In the case of a woman who had been missing for a period of nine months,—whose body was found in the soil of a privy, so decomposed that the bones separated from the soft parts,—the womb was of a reddish colour, hard when felt, and its substance was firm when cut. The fact was of importance. It was alleged that the deceased was pregnant by a young man, and that in order to conceal her condition he had murdered her. From the state of the womb, Casper was able to affirm that this organ was in its virgin condition, and that the deceased was not pregnant at the time of her death. On this representation the accused was liberated. ('Ger. Leich.-Oeffn.,' vol. 1, p. 93.) In examining bodies many months after interment, and in one case upwards of a year, we found that, while other soft organs were decomposed, the womb had scarcely undergone any change—its substance was still firm and hard.

It may happen that the appearances in the womb are sufficient to create a strong suspicion that a woman has been pregnant, but the ovum, embryo, or fœtus may have been expelled: in this case several medico-legal questions will arise in reference to delivery.

Legal Relations.—There are two cases in English jurisprudence in which proof of the pregnancy of a woman may be required. It is impossible that a medical opinion can be given in either case until the woman has undergone examination. If she is acting *bonâ fide*, it is to her interest to submit to this, and the medical man incurs no responsibility. Assuming that an opinion is required on the pregnancy of a woman who refuses to be examined, a medical man would be acting illegally in compelling her to undergo an examination, and he might bring on himself a charge of indecent assault. It is only by the free consent of the woman that such an examination can be at any time made. (See Infanticide, *post.*)

In the two cases in which opinions are usually required, a woman alleges that she is pregnant, but she would not be benefited by the allegation until she had undergone an examination. One of them relates to the civil, and the other to the criminal law. 1. Under a writ *de ventre inspiciendo.* When a woman asserts that she is pregnant and is likely to give birth to a posthumous child, the heir-at-law to the estate may claim a right to have her statement verified and proof given that she is really pregnant. The object of this proceeding is to prevent the possibility of the heir being defeated of his rights, by the fraudulent substitution of the child of another person. Formerly, the proof of pregnancy in such cases was entrusted to matrons nominated by the sheriff, but now the matter is more considerately left to skilled medical practitioners. There will be no difficulty in such a case, provided the pregnancy is at all advanced. Examinations may be made at intervals, until the motions of a fœtus are clearly perceived, with the other concomitant signs above described. An examination of this kind should be made completely. No woman should be able so to feign pregnancy as to deceive a skilled medical man. 2. The other case, referring to criminal law, is where a woman, after a capital conviction, pleads her pregnancy in bar of execution. If she is pregnant, the execution of the sentence is postponed until after her delivery. The strict letter of the law requires that married women taken from any who may be in court should be impaneled to examine the convict and report on her condition. They are required to decide whether she has or has not passed the stage of quickening. It is, however, now the general practice to direct the examination to be made by medical men, for the purpose of avoiding those mistakes into which a jury of ignorant matrons has frequently fallen.

These are the only cases in which pregnancy appears to have any direct relation to medical jurisprudence; and it is remarkable that, with respect to them, the law of England has expressly provided that they should be left to the decision of non-medical persons. The following conclusions may therefore be drawn:—1. That the cases in which the signs of pregnancy become a subject of *legal* inquiry in England are rare. 2. That there is no case, in English law, in which a medical man will not have an opportunity of performing an examination *per vaginam,* but this can only be made with the consent of the woman. 3. That a medical opinion is never required by English law-authorities until the pregnancy is so far advanced as to render its detection *certain.* Hence discussions concerning areolæ, the condition of the breasts, the presence of kiestein in the urine, &c., are, in a practical point of view, unnecessary to a medical jurist. By these remarks we do not intend to undervalue the importance of an accurate knowledge of the signs of pregnancy to a medical practitioner. Cases which may never come before a court of law will be referred to him, and the serious moral injury which he may inflict on an innocent woman by inaccuracy should make him cautious in conducting an examination and in expressing his opinion. The medico-legal questions connected with the pregnant state have been comprehensively examined by Stolz. (‘Ann. d’Hyg.,’ 1873, t. 2, p. 137.)

DELIVERY.

CHAPTER 45.

DELIVERY IN THE LIVING.—CONCEALED DELIVERY.—SIGNS OF ABORTION IN THE EARLY STAGES OF PREGNANCY.—SIGNS OF RECENT AND REMOTE DELIVERY.—FEIGNED DELIVERY.—DELIVERY IN A STATE OF UNCONSCIOUSNESS.—SIGNS OF DELIVERY IN THE DEAD.—TRUE AND FALSE CORPORA LUTEA.—CHARACTERS OF THE OVUM OR EMBRYO.—MOLES.—CONCEALMENT OF BIRTH.

Delivery is a subject which much more frequently requires medico-legal intervention than pregnancy. It will be sufficient to state that the concealment of birth, the crimes of abortion and infanticide, with questions relative to supposititious children, are closely dependent on the proof of parturition. This subject will admit of being considered under two heads:—1. As it relates to delivery in the *living*. 2. As it relates to delivery in the *dead*. In undertaking the investigation, we ought, if possible, to ascertain, either from the female herself or from those around her, whether there was reason to suspect that she had been pregnant. If we can acquire any knowledge on this point, it will materially facilitate our inquiry; but this is not always possible. It has generally happened that previous pregnancy has been so concealed that few who saw the woman suspected her condition; then again, as the admission of her delivery may be the strongest proof of her criminality, she will perhaps resolutely deny it; and a medical practitioner has no right to extort this admission from her. From this it will be seen that a medical witness must often be prepared to prove the fact of delivery, against the woman who is criminally charged.

Delivery in the Living. Concealed Delivery.—The signs of delivery in a *living* woman vary materially according to the time at which this event has taken place. In common language, if the contents of the womb are expelled before the sixth month, the woman is said to miscarry, or to have an abortion; if after the sixth month, she is said to have a premature labour. The law does not admit any such distinction; the expulsion of the ovum, fœtus, or child by criminal violence, at any period of utero-gestation, is regarded as a miscarriage or abortion. It has been well observed that the signs of delivery are indistinct in proportion to the immaturity of the ovum. Thus, when it takes place at the second or third month, there are scarcely any proofs which can be derived from an examination of the woman. All the ordinary signs of delivery at the full period will be absent—the development of the embryo not having been sufficient to cause any prominence in the abdomen, or to give rise to those changes in the system which take place previously to the birth of a mature child; *e.g.* enlargement of the breasts and dilatation of the mouth of the womb. Abortion at this period (the second or third month) is generally accompanied by loss of blood, which may manifest itself by its effects on the body. This, however, can only give rise to a suspicion. At a later period of gestation there may be a discharge resembling the lochia, and the mouth of the womb may be found enlarged and soft; but from the small size of the fœtus, the outlet may present no positive evidence of delivery. The quantity of blood lost may be greater, and may have a more decided effect on the system. Of course, if the ovum, fœtus, or any of its membranes be found, then the presumption of abortion will be strongly supported; but women who designedly conceal their condition will commonly take effectual means to prevent the examiner from obtaining evidence of this kind.

Signs of Recent Delivery in the Living.—The woman is weak, the countenance pale, the eyes are surrounded by livid areolæ, and there is an appearance of general indisposition. Any severe illness may, however, give rise to similar symptoms. Their sudden occurrence from a state of previous good health, especially when pregnancy is known or suspected, will create a strong suspicion. The *breasts* are large and full, especially about the third or fourth day after delivery; the nipples are enlarged, and the areolæ around them present all the characters of advanced pregnancy. If the appearances described are not well marked at the first examination, they may be seen at a later period; and in a doubtful case, when the embryo or fœtus is not forthcoming, a second examination should be made before a final opinion is given.

1. The *skin* of the abdomen is relaxed, sometimes thrown into folds; the cuticle interrupted by light-coloured broken streaks (*lineæ albicantes*), passing especially from the groins and pubes towards the navel, which is more or less stretched and altered in appearance. Any disease which has caused enlargement of the abdomen may give rise to a similar appearance in the skin, so that, when taken alone, much confidence cannot be placed in these lines or streaks as proofs of delivery. The round form of the enlarged and semi-contracted womb may be felt at the lower part of the abdomen, generally lying towards one or the other side. The apparent size of this organ will depend upon the degree to which it has contracted, and therefore greatly upon the time at which an examination is made. Montgomery has pointed out the existence of a dark line extending from the pubes to the navel, with a dark areola round the latter, in cases of recent delivery; but he has found this line to exist independently of pregnancy and delivery—in one case in a girl aged 10, and in another instance in a lady labouring under an ovarian tumour.

2. The *organs of generation* will be found externally swollen, contused, or even lacerated, with clots of blood about them. The outlet is much dilated, the vagina relaxed, the mouth of the womb considerably open, and its margin much relaxed. The neck of the womb is shortened, and scarcely perceptible; and the body of this organ is from

two to four times the size which it has in the unimpregnated state. It occasionally happens that the neck of the womb is lacerated on one side during the passage of the head in primiparæ; should a laceration or a cicatrix be found, it will much assist in proving delivery.

3. *The Presence of the Lochia* (from λόχος, child-birth).—This is a discharge, at first of a sero-sanguineous liquid, but which afterwards appears as a brown or green-coloured serum. It commences soon after delivery, and continues from a week to a fortnight, or even longer; it may be absent after the third day. The discharge has so peculiar an *odour* that some have regarded this alone as furnishing strong evidence of recent delivery.

The signs which have been here enumerated are found only when no delay has taken place in making the examination, and the woman has been *recently* delivered. In some strong and vigorous women, the body resumes its natural state within a few days, and the traces of parturition may have wholly disappeared or have become so ambiguous as to furnish no satisfactory evidence. In others, again, proofs of delivery will be obtainable for a fortnight or three weeks afterwards. In most cases, however, it is difficult, if not impossible, to say, after the lapse of *eight or ten days*, that delivery has certainly taken place, the signs having commonly by that time disappeared. In all cases, the earlier the period at which an examination is made, the more satisfactory will be the evidence obtained. Montgomery once examined a woman *five days* after her delivery at the full time, and he was particularly struck with the degree to which the parts had become restored to their ordinary condition, especially the mouth and neck of the womb, which hardly differed from their natural and unimpregnated form. This inquiry becomes of considerable importance in a case of alleged child-murder. When the body of a child is not found until after two or three weeks from the time of its birth, and the suspected woman denies that she has been delivered of a child, she will probably not deny her pregnancy, but may assert that she has had an abortion at an early period. (See a case in 'Vierteljahrsschr. für Gerichtl. Med.,' Oct. 1863, p. 275.) In cases of abortion at an early period, the placenta is not always discharged at the time at which the embryo or fœtus is expelled from the womb. ('Med. Times and Gaz.,' i. p. 1859.) A microscopical examination of the discharges might reveal placental or chorionic structures. In a case which occurred to Paxton, all the usual signs of delivery were present in a woman æt. 20; she had evidently lost much blood, and was much reduced. From the state of the organs, Paxton considered that she had been delivered of a child within three days. There was no lochial discharge at the date of examination. The woman had previously denied her pregnancy when charged with concealment of it, but after the medical examination she altered her statement, and said that she had not only been pregnant, but was so at that time. On a further examination, the womb was found to contain a fœtus advanced to about the sixth month, and in three months more she was delivered of a child. What caused the appearances of delivery, the condition of the breasts, &c.? Either she had shortly before been delivered of a child, or of a blighted ovum or fœtus. Neither fœtus nor placenta was ever seen or could be found, but the woman had had ample opportunity to dispose of them. This may have been a case of twin conception or of superfœtation. It shows that, in charges of concealment of pregnancy or delivery, it must not be inferred when the appearances of delivery clearly exist, that the womb is empty. The organ should always be examined in order to determine whether it contains another fœtus.

Signs of Delivery at a Remote Period.—A question may arise whether it is in the power of a medical practitioner to determine the period at which delivery took place, *i.e.* how long a time has elapsed. This becomes necessary when, in cases of concealed birth, abortion, or infanticide (some time after suspected parturition), a child is found, and it is required to determine whether the time which has elapsed since the birth of the child, either dead or living, corresponds with the supposed delivery of a suspected woman. An opinion may be given within eight or ten days after delivery, from the state of the breasts, of the discharges (lochia), and of the mouth of the womb; but it becomes difficult after the sixth day; and when the tenth or twelfth day has passed, it is still more difficult. After two or three months, it may be regarded as impossible to assign the date of delivery with any degree of precision. (See Devergie, 'Méd. Lég.,' vol. 1, p. 446.)

In a case of pretended delivery, congested legitimacy, or disputed chastity, a medical jurist may be required to say whether a woman has, at any antecedent period of her life, been delivered of a child. This question, it must be remarked, can be raised only in respect to delivery at the full period, since there is no doubt that abortion in the early stages of pregnancy may take place, and leave no traces of such an event discoverable in after-life. Indeed, a few days or weeks are sometimes sufficient to obliterate all evidence of the fact. With respect to delivery at the full term, certain signs have been mentioned, which by some are considered indelible. These are—shining streaks on the skin of the abdomen, a brown mark reaching from the navel to the pubes, and the state of the mouth of the womb, which is said never to close so effectually as in the virgin. In regard to the appearance of the skin of the abdomen, it may be remarked that any morbid causes giving rise to a distension of the cavity—as ovarian enlargement or dropsy—will produce the same effect; so, also, to a certain extent, extreme emaciation from a state of obesity. (See 'Med. Times and Gaz.,' 1861, i. p. 450, on False Cicatrices.) Then, again, these marks on the skin are not always persistent throughout life. Besides, a woman, according to the statements of good observers, may be not only once, but repeatedly delivered, without having these marks produced. ('Med. Times and Gaz.,' 1860, i. p. 583; also 'Ann. d'Hyg.,' 1873, t. 2, p. 139.)

With regard to the state of the mouth of the womb, it is liable to vary in different women, and to be affected by disease—so that a certain judgment cannot always be formed from its condition. In a woman who has not borne children, the mouth of the womb is in the form of a slit, the angles being bent down, and giving to it the appearance of the os tincæ (tench's mouth). Whitehead has observed that in a woman who has borne children, the mouth becomes elongated, and loses the slight bend at each of its extremities; the labia are thickened, and more nearly of equal size; the commissures are less clearly defined, and the whole of the neck is enlarged, and not so compact in texture. ('On Abortion,' p. 195.) It must be remembered, however, that the condition of the mouth of the womb, even in the virgin, varies at each menstrual period. Should there be congenital occlusion of the vagina or the hymen be found imperforate, this will at once negative a previous delivery; but the latter condition will not negative a previous pregnancy, since a woman may have been impregnated, and have had an abortion in an early state of pregnancy, without a necessary destruction of the hymen. This sort of negative evidence may, however, be sometimes of great value. There is a total want of good affirmative evidence of delivery at a remote period in the living, if we except that which is furnished by the presence of cicatrices in the vagina or of a cicatrix as a result of a lacerated perineum. It is rare, however, that any decision on this subject is required in medical jurisprudence. It might be demanded, either in a case of infanticide, when a woman was accused of having destroyed her alleged offspring some months or years before; or in a case of contested legitimacy, when a female is accused of having substituted a child of which she pretends she had been delivered at some remote period of time.

Feigned Delivery.—Delivery has often been feigned by women for the purpose of extorting charity, compelling marriage, or disinheriting parties who have claims to an estate, and in other cases without any assignable motive. Of course, an imposition of this kind could not be sustained before a medical practitioner: and detection is rendered easy; because it is *recent* and not *remote* delivery which is assumed. The latter would, if pretended, be generally cleared up by an examination, as well as by circumstantial evidence. (See case, 'Lond. Med. Gaz.,' vol. xix. p. 231; also another by Capuron, 'Méd. Lég. des Accouchemens,' p. 110.)

Can a Woman be delivered unconsciously?—Another important question relative to delivery in the living is whether a woman can be delivered without being *conscious* of it. The signs of delivery may be discovered by a practitioner; the offspring may also be found; the woman may admit the fact of her delivery, but alleged that she was totally unconscious of it. The only medico-legal case in which this plea is occasionally raised is in infanticide; and as the possibility of the occurrence may be questioned, the practitioner must be provided with a knowledge of those facts which medico-legal writers have accumulated respecting it. There is no doubt that a woman may be delivered unconsciously during profound sleep—while labouring under coma, apoplexy, asphyxia, syncope, or when suffering from the effects of narcotic poisons—*e.g.* the vapours of chloroform and ether, or intoxicating liquors. It is said, also, that delivery has taken place spontaneously while a woman was in the act of dying. This, however, has no bearing on the present question. It is in those cases where, after her recovery, a woman pleads unconsciousness of delivery that medical practitioners are chiefly consulted. Besides the cases enumerated, hysteria, when accompanied by loss of sense and motion, has been mentioned as a state in which parturition is liable to occur unconsciously. We need not be surprised at delivery taking place under these circumstances, when we consider that the contractile power of the womb is altogether independent of volition; but, unless the morbid states already mentioned are accompanied by the most profound lethargy and entire loss of sensation, it can rarely happen that the contractions of this organ in its efforts to expel the child should not at once rouse a woman into consciousness. We ought particularly to expect this in primiparæ, *i.e.* in those who have never before borne children. At the same time, it must be remembered that parturition in some women, especially when the pelvis is wide and the child small, may take place with such rapidity and ease as scarcely to be accompanied with pain.

It has been observed that, when a woman has frequently borne children, delivery sometimes takes place without effort, and without any consciousness on her part. On other occasions a woman may lie in a kind of torpor or stupor, or suffer from puerperal convulsions, and have no recollection of her delivery. The following case is possible: a woman may be delivered while under the influence of puerperal convulsions, which might have attacked her before labour set in; and after delivery, but before complete recovery, she might become maniacal —a not unfrequent condition—during which interval she may have killed or injured her child; or the child may have been born dead or suffering from some accidental injury. She would with truth assert her entire ignorance of it. Her statement would be verified by a bitten tongue, and a congested conjunctiva or face. Should albumen be found in the urine, this fact would be still more confirmative. Of course, puerperal convulsions occur without these results. The statement might be disproved by finding that her actions had shown care and design in other circumstances at the time she said she was unconscious. King has described the case of a woman, æt. 36, the mother of nine children. She received his assistance in her tenth labour: when summoned, she was lying calmly and placidly in bed, and was perfectly insensible. He found that the child had been expelled with the placenta. The woman did not recover her consciousness for ten or twelve hours, and then stated that she had no recollection either of the birth of the child or of any circumstances connected with this event: she suffered no pain or uneasiness. Another case is mentioned by him in which sensation appeared to be entirely paralysed during labour. ('Med. Times,' May 15, 1847, p. 234.) It is beyond doubt that profound lethargy occasionally makes its appearance about the time of delivery. Schulze met with a case in which a woman remained in a state of sleep for three days, and was delivered while in this unconscious condition: on awaking, she had no recollection of having suffered any pain during delivery. ('Ann. d'Hyg.,' 1842, t. 1, p. 216; 'Lond. Med. Gaz.,' vol. xxxvi. p. 40.) Montgomery relates the case of a lady, the mother of several children, who, on one occasion, was unconsciously delivered during sleep. ('Cyc. Pr. Med.;' see also case in 'Brit. and For. Med. Rev.,' No. 9, p. 256.) Palfrey described a case in which labour commenced and progressed in a woman to the second stage during sleep. ('Lancet,' 1864, vol. i. p. 36.)

The results obtained by the use of the vapours of chloroform and ether show that the expulsive efforts of the womb are often as energetic in the unconscious as in the conscious state. It may appear extraordinary, however, that a primiparous woman, unless rendered unconscious by narcotic substances, should be delivered without suffering pain; nevertheless, a case of this kind is recorded by Wharrie. The woman's age was 21; she had been in labour about six hours; she complained of no pain, and the child was born without effort or consciousness. The child was healthy, but small, weighing rather more than four pounds. ('Cormack's Jour.,' Jan. 1846, p. 12.) Notwithstanding this case, it is in the highest degree improbable that any primiparous female should be delivered during *ordinary sleep*, without being roused and brought to a sense of her condition.

There is another condition in which a woman may state that her delivery took place unconsciously; and this, from its being one of the most common species of defence set up by a female charged with child-murder, must here claim our attention. Thus she will allege that, while suffering from pain, she felt a strong desire to relieve her bowels; that she went to the closet for that purpose, and was there delivered without knowing anything of the occurrence, until it was too late to save the child. This kind of desire is a very common symptom of the parturient state; and it is often difficult to restrain a woman from yielding to the feeling, when it certainly would be attended with hazard to the child. ('Med. Times and Gaz.,' 1857, i. p. 347.) We must, therefore, admit that an accident of this kind can occur; although here, as in every other instance in which unconscious delivery is pleaded, a medical witness ought to inform himself, or be informed, of all the particulars which are stated to have attended delivery, before he gives an answer applicable to the case. As a general rule, it cannot be denied that delivery may take place under these circumstances, and a woman not be conscious of it; but before we make this admission in regard to any particular instance, we ought to have a statement of all the facts from the female herself. It is thus that we shall avoid the risk of seeing a premature medical opinion set aside by the subsequent production of circumstantial evidence. Besides, it has been properly observed that, *after* an accident of this kind, a woman cannot be ignorant of her having been delivered. Women who have raised this plea in cases of child-murder have often been known to maintain that they were unconscious of their pregnancy, and thus have attempted to excuse themselves for not having prepared the articles necessary for child-birth. It is possible that a woman, especially one who is pregnant for the first time, may not be aware of her pregnancy in the earlier stage; but it is rare for one to advance to the full term without being conscious of it. Women who have borne children have not unfrequently consulted medical men; and although nearly at full term, they have been unconscious of their state. In the majority of instances, it may be presumed that a woman thus situated must have some reason to *suspect* her condition; and if only a suspicion existed in the mind of one who did not contemplate the destruction of her offspring, there would be many circumstances forthcoming which would at once establish her innocence. If this remark applies to married women, it applies with still greater force to those who are unmarried, since the fact of illicit connection, and the fear of its consequences, must render them peculiarly alive to all those changes which, by common repute, take place during pregnancy.

Signs of Delivery in the Dead.—It will now be proper to examine the signs of delivery which are derivable from an examination of the body of a woman after death. Occasionally we may obtain some history of the case during life, by which our labour will be much facilitated; but, on the other hand, every fact may be studiously concealed from us, and then we may be required to prove, not only the delivery, but the previous pregnancy. These investigations relative to pregnancy and delivery in the dead body are almost exclusively confined to cases of criminal abortion, where the contents of the womb have been expelled at the sacrifice of the life of the woman. Death commonly ensues in these cases within two or three days after delivery, and then satisfactory proofs are obtainable by a post-mortem examination; but if the woman has survived three or four weeks, it will be as difficult to determine delivery in the dead as in the living subject. This remark applies to delivery at the full period; for if the womb have expelled its contents in the first months of pregnancy, the traces of this expulsion will have generally disappeared in the course of a few days.

The following may be taken as the chief appearances when the body of a woman is examined soon after delivery at the *full* period:—The womb is like a large flattened pouch from nine to twelve inches long, its mouth being wide open. The cavity contains clots of blood or a bloody fluid; and its surface is covered with the remains of a decidua—the outermost membrane of the embryo or fœtus. In the part to which the placenta has been attached, the substance of the organ appears exposed, presenting several large semilunar or valvular openings. This portion of the womb has been found of a very dark colour, which has given rise to a suspicion that the organ was gangrenous. The vessels are extremely large and numerous. The Fallopian tubes, round ligaments, and ovaries are so vascular (full of blood) that they have a purple colour. The spot whence the ovum has escaped is more congested than the rest of the ovarian surface. Obstetric writers differ greatly in their statements respecting the size of the womb at different periods after parturition; and these differences may be explained, partly by the fact that the womb contracts more rapidly in some women than in others, and partly perhaps by the circumstance of the birth having been in some instances premature. Toulmouche has reported some instructive cases of delivery at different periods, showing the influence of time on the appearances. ('Ann. d'Hyg.,' 1864, t. 2, p. 349.)

Montgomery states that after delivery at the full period, and under perfect contraction of the womb, if the body be examined within a day or two, the womb will be found seven inches long and four broad. Its substance, on making a section, will be from an inch to an inch and a half in thickness, and will present the orifices of a great number of large vessels. At the end of a week, the womb is between five and six inches, and at the end of a fortnight about five inches, in length; the density of its structure has during this period increased, but its substance has considerably diminished. The inner surface is still bloody, and covered partially with a pulpy membrane resembling the decidua. The orbicular direction of the fibres around the internal orifices of the Fallopian tubes is at this time very distinct. In about a month, the womb will have become fully contracted; but the mouth rarely, if ever, closes so completely as in the virgin state. In a case examined by Barnes, in which a primiparous woman, æt. 26, died from puerperal fever on the *sixth day* after delivery, the following appearances were met with in the womb:—The internal surface was blackened and congested, especially in those parts to which the placenta had been attached. There was the appearance of suppurative action in this part. The substance of the womb was healthy; there was no pus in the sinuses. The mouth of the womb showed considerable ecchymosis. The vagina was healthy; the iliac veins contained nothing but loosely coagulated blood. There was in the left ovary a small well-marked corpus luteum, having a central cavity. ('Lond. Med. Gaz.,' vol. xli. p. 294.) This condition of the womb must not be confounded with the appearances which are observed when death takes place during *menstruation*. Judee found in the bodies of three women who died during menstruation that the womb was somewhat enlarged —its walls being thickened and its interior lined by a reddish gelatinous layer about 1-12th of an inch thick, consisting of a capillary network of vessels, enclosed in a mucous-like membrane. When this was removed, the womb below was found to be white and firm. The interior of the neck was of a greyish colour; the lips were swollen, of a dull-red, bluish, or even black colour. On compressing this part, small drops of blood issued. This was not observed either in the neck or body of the vagina. A section of the womb presented only the normal fibrous tissue; but at the level of the mouth (os uteri) there was a mass of tissue resembling a portion of an apoplectic lung. The blood during menstruation, according to him, issues entirely from the highly congested mouth of the womb. ('Med. Times and Gaz.,' 1855, i. p. 632.) An ecchymosed condition of the neck of the womb is very commonly found as the result of even an easy labour, and therefore forms a good guide where present. This point must be borne in mind in reference to criminal abortion, inasmuch as the neck may present an appearance as if violence had been employed.

From the statement of appearances given above, it will be seen that there must be considerable difficulty in determining the period prior to death at which delivery took place. The difficulty is increased when a woman has been prematurely delivered, or when death has not taken place until some time after delivery. A medical opinion may be then in some degree strengthened by searching for those signs which have been described as characteristic of delivery in the living. These, if present, will always furnish strong corroborative evidence, not only of the fact of delivery, but of the period at which it had probably occurred.

Parity and Nulliparity.—The medical question whether a woman has ever borne a child or not may be material in reference to proof of identity. In *Reg.* v. *Wainwright* (C. C. C., Dec. 1875, *ante*, p. 323), the charge against the prisoner was that he had murdered Harriet Lane, a woman with whom he had cohabited. She had been missing a whole year, and the remains of a woman were found buried in premises belonging to the prisoner; they had been cut up into various portions, and were so mangled and decomposed that it was necessary to establish the identity of the body as that of the missing woman. One of the medical points raised referred to the condition of the womb —*i.e.* whether the appearances which this organ presented were such as to indicate conclusively that the deceased had borne children. The missing Harriet Lane had had two children by the prisoner, the last having been born some time before Christmas, 1873; therefore about nine months previous to her disappearance. From their examination of the womb, Larkin and Bond came to the conclusion that this woman had borne a child. Meadows, who appeared as a obstetric expert for the defence, stated that, in his opinion, the woman of these remains had never borne a child. He qualified this opinion, however, by stating that he believed it to be impossible to decide this question in any case with absolute certainty. If this witness had been able to swear positively that the indications of childbearing were absolutely certain, and could never be mistaken for a virgin or unimpregnated state of the womb, his evidence would have gone far to show that this could not have been the body of Harriet Lane. He felt, however, he could not carry his evidence to such an extent, and the effect of it simply amounted to a difference of opinion on the answer to this question. ('Brit. Med. Jour.,' 1875, ii. p. 744.) The condition of the womb, according to the evidence for the prosecution, was inconsistent with virginity. This organ was in every way enlarged. It was flaccid, and the walls were unusually thin. There were one or two white lines (*lineæ albicantes*) in the skin of the lower part of the abdomen, and other marks of a darker colour in the inguinal region. The obstetric expert for the defence considered that the shape of the womb and thinness of its walls indicated that the deceased was nulliparous, *i.e.* that she had never borne a child. The evidence of the medical witnesses for the prosecution was strongly corroborated by a number of facts tending to prove that this was the body of Harriet Lane, and the prisoner was convicted. It would appear from the discussions on this case that took place at the Obstetric Society, that medical science alone cannot at present furnish a certain answer to this question. ('Trans. Obst. Soc.,' 1876, vol. xvii. p. 355; and vol. xviii. p. 69.)

Corpora Lutea.—The condition of the *ovaries* has been considered to furnish strong evidence, not so much of delivery as of previous pregnancy. These organs, as it has been already stated, when examined soon after delivery, are found of a deep purple colour, owing to their extreme vascularity. If the woman has really been pregnant, we may expect to find, on one of the ovaries, the appearance which is denominated a *corpus luteum.* The accounts given by obstetric writers of the characters of corpora lutea, and the evidence which they are capable of furnishing in legal medicine, are very conflicting. According to Montgomery, in a *true* corpus luteum (*i.e.* of pregnancy) the ovary presents a protuberance with a distinct cicatrix on the part whence the ovum has escaped. The protuberant portion will be found, on section, to have an oval form and to be of a dull yellow colour—hence the name *corpus luteum.* It is full of blood, and in texture resembles the section of a kidney. It is of its greatest size in the early stage of pregnancy, and gradually diminishes as gestation advances. In the centre of this section there may be either a *cavity* or a radiated white *cicatrix* (scar), according to the period at which the examination is made. The cavity remains for about three or four months after conception, and is surrounded by a dense white cyst; as gestation advances, the opposite sides approximate, and a radiated white cicatrix results. The size and vascularity of the corpus luteum are considerably diminished by the time gestation is completed, and in about five or six months afterwards—*i.e.* fourteen months after its first formation —it disappears altogether from the ovary; so that the corpus luteum of one conception is not found with that of another, unless a premature expulsion of the contents of the womb has taken place. ('Cyc. Pr. Med. Pregnancy,' p. 496; see also 'Edin. Med. Jour.,' 1845, i. p. 58.) The presence of a corpus luteum, as it is here described, does not prove that a woman has borne a child. In the opinion of some obstetric authorities, it establishes that conception had taken place; but the embryo may have been converted into a mole or blighted fœtus and expelled at an early period.

Baly and Kirkes concluded from their researches that cases seldom occur in which the mere presence of a corpus luteum can be taken as a proof of previous impregnation; and they consider the following rules to be deducible from the facts which they have collected:—1. A corpus luteum in its early stage (that is, a large vesicle filled with coagulated blood, having a ruptured orifice and a thin layer of yellow matter within its walls) affords no proof of impregnation having taken place 2. From the presence of a corpus luteum, the opening of which is closed, and the cavity reduced or obliterated (only a stellate cicatrix remaining), no conclusion as to pregnancy having existed can be drawn, if the *corpus luteum be of small size,* and does not contain so much yellow substance as would form a mass the size of a small pea. 3. A similar corpus luteum of larger size than a common pea would furnish strong *presumptive* evidence, not only of impregnation having taken place, but of pregnancy having existed during several weeks at least; and the evidence would approximate more and more to complete proof in proportion as the size of the corpus luteum was greater.

From these considerations, therefore, it appears to us that the only conclusion which we can draw is that medical evidence respecting the nature of a corpus luteum in an unknown case, if received by a court of law at all, should be received with the greatest caution, and only from a witness of great experience. The old doctrine on this subject, that the presence of such a body on the ovary affords *certain* and undeniable evidence of impregnation, may be regarded as completely subverted.

Characters of the Ovum or Embryo to the Sixth Month.—Hitherto the examination has been confined to the woman, but it is now necessary to describe the characters of the ovum, or embryo and its enveloping membranes at the early stages of pregnancy, since, when this can be procured, it may furnish good medical evidence. The 'ovum' signifies the embryo and its membranous coverings; the 'embryo' is the body which is afterwards converted into the fœtus; the term 'fœtus' is applied to the embryo after the third or fourth month of gestation. If the ovum be expelled within a *month* after conception, it is scarcely possible to detect it, owing to its small size and its being enveloped in clots of blood. Burns examined three wombs, within the first month, where no expulsion had taken place, but even under these favourable circumstances he failed to discover the ovum. At first, the ovum contains no visible embryo, but it appears merely to consist of vesicular membranous coverings. According to this authority, when first distinctly seen through its membranes, it is of an oblong form and about a line (the twelfth of an inch) in length. At the *sixth week*, it is slightly curved, resembling, as it floats, a split pea. In the *seventh week*, it is equal in size to a small bee; and by the end of the *second month*, it is bent, and is as long as a kidney-bean. After the second month, development goes on rapidly; the features are in part well-marked, and the limbs are gradually formed. At the *third month*, the fœtus weighs from one to two ounces; when stretched out it measures about three inches, and the genital organs, although the sex is not then distinguishable, are large in proportion to the rest of the body. The membranes are larger than a goose's egg. At the *fourth month*, the fœtus is from five to six inches long, and weighs from two to three ounces; at the *fifth month*, it measures from six to seven inches, and weighs from five to seven ounces; and at the *sixth month*, its length is from eight to ten inches, and its weight is about a pound. (For the characters of the child beyond this period, see Infanticide, *post.*) The great difficulty will consist in determining the nature of the supposed ovum or embryo between the second and third months. In making the examination, the ovum should be placed in water, and all clots gently washed away from the membranous coverings or removed by some blunt instrument. Alcohol may be used as a substitute for water after the blood has been removed. If the embryo cannot be found, the decidua and chorion or portions of them may be recognized—the former by its forming the outer investment with its smooth internal, and rough external or uterine surface; the latter by the villous or shaggy appearance of that portion of it which would have become the placenta. Between the third and fourth months, the fœtus may be commonly identified without much difficulty. The ovum in many instances escapes first, leaving the decidua behind. This comes away after a time, but it is important to remember that in some states of the virgin, decidua-like structures are thrown off from the uterine mucous membrane, which, when examined by the microscope, resemble the true decidua. Both are constituted of the innermost portion of the uterine mucous membrane, and contain all its elements. Keiller ('Edin. Med. Jour.,' 1865, ii. p. 82) and Bell (ibid., p. 120) have called attention to the fact that an erroneous medical opinion on the date of pregnancy may be formed by trusting too much to the appearance of the ovular membranes. The ovum or fœtus may die, and the membranes afterwards continue to grow, thus giving the appearance of a more remote date to pregnancy. An examination of the embryo alone can give any satisfactory results on this point. The membranes may be also enlarged as the result of dropsical accumulation, and this may be set down to pregnancy of some duration, when it may not actually have extended beyond the second or third month.

A *mole* is the result of conception, the fœtus having died in consequence of the effusion of blood into the decidua and the various membranes, and, should a placenta exist, into its structure. The symptoms accompanying a mole resemble those of pregnancy; and the appearances produced by its expulsion are not to be distinguished from those attending the abortion of a fœtus at an early period of gestation. The only means of distinction would be derived from an examination of the expelled matters. The local effects produced on the organs of generation by the expulsion of these bodies are by no means so great as those arising from delivery at the full period.

When from some accident the fœtus dies at any time before the complete formation of the placenta, the villi of the chorion, instead of completely dying, grow imperfectly; whilst serous fluid is effused within and the part is distended into a globular form. This is called a *vesicular mole*. In the early stage of pregnancy, a decidual covering will always be found more or less complete around this mole, but if the size of the mass be great, then, although present, it will be less observable, being spread over a larger surface. A *corpus luteum* will also be found, but not so perfectly formed as in normal pregnancy. The ordinary symptoms of pregnancy accompany this state, although in all forms of mole-pregnancy it is either imperfectly marked or it only proceeds to a certain point. (See case, 'Obst. Rec.,' vol. i. p. 21.) It is also to be remembered that the effects produced by the expulsion of a mole are very similar to those of an abortion. These facts may have an important bearing in medico-legal practice.

Concealment of Birth.—Medical evidence respecting delivery is required in two cases: first, when the birth of a child is wilfully concealed; and second, when the contents of the womb have been prematurely expelled by criminal means. The concealment of pregnancy is no offence in the English law; but the concealment of *delivery* or of *the birth* of a child is a misdemeanour by the 24 & 25 Vict., c. 100, sec. 60, the words of which are to the following effect: 'If any woman shall be delivered of a child, *every person* who shall by *any secret disposition* of the dead body of the said child, whether such child died before, at, or after its birth, endeavour to conceal the birth thereof, shall be guilty of a misdemeanour.' Willes, J., remarked upon the statute that women tried on this charge are punished, not for concealment of birth, but concealment of the body—a distinction which not only increases the difficulty of obtaining evidence, but excites hope in the criminal that, if she can finally do away with the body, she may be free of the law. Various interpretations have been put upon the terms 'concealment' or 'secret disposition' of the body. This part of the evidence does not affect a medical witness, unless he himself has found the dead body or was present when it was found. It will rest with the judge to determine whether the body has been so disposed of as to constitute a misdemeanour. (*Reg.* v. *Clarke*, Chelmsford Sum. Ass., 1864.)

Medical men must be here cautioned, as in some other crimes committed by women, that they have no legal right, except by the consent of the woman, to examine her person in order to ascertain whether she has been recently delivered or not. According to English law, no person is bound to furnish evidence against himself or herself. A medical man who neglects this rule may find himself charged with an indecent assault, and be sued for damages.

In *Agnew* v. *Jobson and others* (Newcastle Lent Ass., 1877), the plaintiff was suspected of concealing the birth of her illegitimate child, of which she was afterwards convicted. An inspector of police, wishing to have evidence of her physical condition, gave to Mackay authority to examine the plaintiff's person. Having some doubt about the legality of the proceeding, he applied to the defendant Jobson, a magistrate, who gave him a written order for the purpose. Jobson, Mackay, and another were sued for damages for an indecent assault. The evidence made it clear that the girl did not give her consent, but her alarm prevented her from resisting. The judge summed up, and the jury returned a verdict for the plaintiff, with 50*l.* damages. ('Brit. Med. Jour.,' 1877, i. p. 336.) A medical man may, however, examine the clothes of the accused, as well as the body of the child, if they are handed to him by the police for this purpose.

This is an offence of which women charged with child-murder are commonly convicted in England; while the Scotch law punishes women for the concealment of pregnancy if the child be dead or amissing. (Alison's 'Crim. Law,' p. 153.) The medical evidence on trials for this misdemeanour in Scotland is exclusively derived from an examination of the mother; and thus much will depend upon the time at which this is made. With respect to the child, its body need not even be produced, provided there be satisfactory evidence of its death; the body may have been secretly buried or burnt, and in the latter case it may be necessary to examine the bones or ashes.

According to the English statute the child must be *dead*—the concealment of the birth of a living child not being any offence, unless it should happen to die before its birth was made known. In the case of *Reg.* v. *Woodman* (Kingston Lent Ass., 1845), the woman was acquitted because the child was living when concealed. Chitty says that, in order to constitute the offence, the child must have advanced to the end of the seventh month ('Med. Jour.,' p. 412); but it is to be presumed that the concealment of the birth of a dead child at the sixth, or under the seventh month, would be as much an infringement of the statute as if it were more advanced. The concealment of the aborted, but undeveloped, ovum or embryo—of a monster, *i.e.* a child without human shape, a mole or other morbid growth—would not probably be considered a contravention of the statute. We are not aware that there has been any judicial decision on this point. Lane communicated to the 'Med. Times' (Aug. 1845) a case in which a charge of concealed birth was dismissed, because the concealment referred to a child born at the eighth month *in its membranes*. The woman stated that she did not consider it to be a child. The case, being entirely new, should have been sent for trial; for a magisterial decision can furnish no precedent on a question of this kind. This woman must have been delivered of a child, fœtus, or embryo, or of course there would have been no pretence for the charge. That a child may be thus born and removed from the membranes alive is a fact established by experience. Brunton reported to the Obstetrical Society a case in which the entire ovum was expelled at the seventh month of gestation, and the child was rescued alive, although born fifteen minutes before being taken out of the membranes. ('Med. Times and Gaz.,' 1871, i. 412.) In another case of sudden delivery the child in its membranes with the placenta was discharged into a bucket. It was not rescued in time to save life. ('Amer. Jour. Med. Sci.,' April, 1870, p. 430.)

From some observations made by the Recorder of London at the Central Criminal Court, Oct. 1865, there appears to be some uncertainty on this point. Thus it is difficult to suggest a proper legal definition of a 'child.' In reference to the case of *Reg.* v. *Knight*, where a woman was charged with concealment of birth, the prisoner admitted to a policeman that she had been delivered of 'a something' (not forthcoming). 'Now, was she delivered of a child, and had she disposed of the body in such a way as to conceal the fact of her having been so delivered? Then what was "a child"?—for those were the words used in the statute. He felt himself a little debarred from expressing his own opinion in reply to this question, because two of the judges had given decisions directly contrary the one to the other upon this subject. One of them said it was not a child unless it had attained that state in which it could live, supposing it had been born alive. If it had attained that state, then he was of opinion that it was a child. The other judge said that this was not his idea of a child; but that if it had the outward form of a child, it was a child according to the statute. The one contended that it ought to have attained to a state in which it had a capability of living (*viability*); and the other that at any rate it should have the outward form of a child. Was there any proof of this kind here? The prisoner herself said she did not know whether she had been in the family way for three months. Taking the widest view of the judges,—Had what was born in this case the outward form of a child? If it had not, then the prisoner was not guilty of the offence charged against her.'

The proposed new Criminal Code contained this provision (section 146): 'No fœtus shall be deemed to be a child within the meaning of this section which had not, when born, reached the period at which it might have been born alive.' This, as it will be seen under Infanticide, is not a fixed period, but no doubt the earliest period at which a child has been known to come into the world living will be taken as the limit.

It will be perceived that it is not material here, as in a case of alleged infanticide, to prove *when* the child died—whether before, during, or after its birth; and thus those subtleties and technicalities which are met with in cases of child-murder are avoided. In regard to proof of concealment, and what constitutes it, these are essentially legal points; but a medical practitioner may sometimes benefit an accused person, if he can prove that the woman had made application to him on the subject of her pregnancy and delivery. The law is especially lenient under such circumstances. A very strict interpretation appears to be put upon this term *concealment*. There must be a 'secret disposition' of the dead body. The medical witness may even have to deal, not with the body, but with the remains in a mutilated state, or burnt. He must be able to prove that they really are *human* remains. In one case (Cornwall Sum. Ass., 1871), the prisoner, a married woman, was charged with the murder of her illegitimate child. The body was found mutilated, and partly burnt. The woman had concealed the mutilated body of the child, and had tried to get rid of it by burning. She said the burnt bones found, and some blood on a rug, were those of a fowl. It was proved, however, that they were the bones of a child, and that the blood was not that of a fowl.

Questions connected with concealment of birth do not fall under the jurisdiction of a coroner; the medical evidence is therefore required by a magistrate.

CRIMINAL ABORTION.

CHAPTER 46.

ABORTION FROM NATURAL CAUSES.—CRIMINAL CAUSES.—MECHANICAL MEANS.—MEDICINAL SUBSTANCES.—SIGNS OF ABORTION.—SPECIFIC ABORTIVES.—LOCAL APPLICATIONS.—FEIGNED ABORTION.—MEANING OF THE WORD 'NOXIOUS' AS APPLIED TO DRUGS.—ON INDUCING PREMATURE LABOUR.—PROOF OF PREGNANCY NOT NECESSARY.—ABORTION OF MONSTERS.—MOLES AND HYDATIDS.

By abortion is commonly understood, in medicine, the expulsion of the contents of the womb *before the sixth month of gestation*. If the expulsion take place between the sixth and ninth months, the woman is said to have a premature labour. The law makes no distinction of this kind, but the term 'abortion' is applied to the expulsion of the fœtus at *any period of pregnancy* before the term of gestation is completed; and in this sense it is synonymous with the popular term *miscarriage*. Criminal abortion is *incorrectly* thought to be rarely attempted before the third month; it is perhaps most common between the fourth and fifth months, because then a woman begins for the first time to acquire a certainty of her pregnancy. The causes of abortion may be either *natural* or *violent*. The latter only fall under the cognizance of the law; but a medical witness should be well acquainted with the causes which are called natural, in contradistinction to others which depend on the application of violence. These *natural* causes are sometimes very obscure, and the real cause is thus often overlooked. They are so frequent, that—according to Whitehead's observation—of 2000 pregnancies, one in seven terminated in abortion. These causes are commonly ascribable to peculiarities in the female system, to the presence of uterine or other diseases, or to some shock sustained by a woman during pregnancy. Any diseases which strongly affect the womb or general system of a woman may give rise to abortion. An attack of small-pox has been known to produce it; and it has been suggested by Acton that the presence of constitutional syphilis in the father is not only a cause of infection in the offspring, but of repeated abortion in the woman. ('Lond. Med. Gaz.,' vol. xxxvi. p. 164; Ramsbotham's 'Obst. Med.,' p. 655.) These facts deserve attention, when it is proved that a woman has really aborted, and an attempt is unjustly made to fix an alleged act of criminality on another. For further information on the numerous natural and accidental causes which may give rise to abortion, the reader may consult the work of Whitehead ('On Abortion and Sterility,' p. 252); and, for the effects of undue lactation and diseases of the placenta, in causing abortion, the 'Med. Times and Gaz.,' 1852, ii. p. 580, and 1853, i. p. 302. In considering the operations of these causes, it is proper to bear in mind that, during pregnancy, the womb is subject to a natural periodical excitement, corresponding to what would have been the menstrual periods dating from the last cessation. Hence comparatively trivial causes operating at these periods may lead to an expulsion of the fœtus. Salomon has reported two cases in which premature delivery followed the mercurialization of the system. ('Lond. Med. Gaz.,' vol. xxxvi. p. 658.)

The *violent* causes of abortion may be of an accidental or criminal nature. In general, the distinction will not be difficult: the kind of violence, and the adequacy of the alleged cause to produce abortion, will be apparent from the evidence. In reference to criminal cases, the causes may be referred either, first, to the use of *mechanical* means; or second, of irritating *medicinal* substances acting upon the womb or bowels. They operate with greater certainty in proportion as the pregnancy is advanced.

Mechanical Means.—Among the mechanical causes may be mentioned —severe exercise, the violent agitation of the body, as by riding or driving over a rough pavement, in which case no marks of violence would be apparent. Any physical shock sustained by the body may operate indirectly on the womb. Violent pressure or blows on the abdomen are sometimes resorted to; but in these cases the marks of violence will be commonly perceptible. Instruments have been devised for the purpose of piercing the membranes, destroying the child, and thereby leading to its expulsion. Devergie speaks of such instruments being well known in England, and of English midwives deriving a living from the practice of this crime. (Op. cit., vol. 1, p. 285.) Although this must be regarded as an exaggerated statement, it cannot be denied that cases have occurred which show that the crime is frequently perpetrated by persons who basely derive a profit from the practice; and for one case that comes to light, probably a dozen are effectually concealed. In the evidence given on four trials within a recent period, the cases presented no feature of novelty or interest. Instruments were employed, and drugs in large doses were proved to have been also administered.

Mechanical means are undoubtedly more effectual in producing abortion than medicinal substances; yet, when the attempt is made by ignorant persons, the woman often dies from inflammation of the womb or peritoneum, or other serious after-consequences. A case was tried some years since, in which the evidence showed that the prisoner had attempted to produce abortion in the deceased, by thrusting wooden skewers into the substance of the womb. Inflammation and gangrene took place, and the woman died. The prisoner was convicted of murder. (For similar cases, see 'Lond. Med. Gaz.,' vol. xxxvi. p. 102; xlv. p. 693.) This kind of injury to the womb always implies the interference of some other person in the perpetration of the crime. Mechanical means often leave marks of violence on the womb, as well as on the body of the child. If the mother should die, an inspection will at once settle the point. ('Ann. d'Hyg.,' 1834, t. 1, p. 191; 1838, t. 1, p. 425; 1839, t. 2, p. 109.) An important case of this kind was the subject of a criminal trial in Scotland in 1858. (Case of *Reid*, 'Lond. Med. Gaz.,' Dec. 11, 1858.) The womb near its mouth presented two openings in its substance, described as punctured wounds by the medical witnesses for the prosecution who made the examination, and as the openings of torn blood-vessels by others who were called for the defence. There was also a rupture of one ovary. The prisoner was convicted; and the medical man, who was supposed to have been the principal agent in the crime, committed suicide. The case is chiefly important in showing that any apparent mechanical injury to the womb should be minutely examined at the time of inspection, so that no doubt of the cause may afterwards be entertained by any present. If, in a case of this kind, the mother should survive and the child be expelled, then marks of violence may be found on its body. These marks may not be sufficient to account for its death; but this is not here the question. If it can be proved that they have not resulted from accidental causes during gestation or subsequently to delivery, then their presence may furnish strong corroborative evidence of the actual means by which abortion was attempted. It is said that abortion has been in some instances accomplished by frequent bleeding from the arm. This effect may follow as a result of shock produced by the sudden loss of a large quantity of blood. An examination of the veins of the arms would show whether any such attempt had been made.

There can be no doubt that of all the exciting causes of abortion, the most effectual, and that which most certainly brings on the expulsive action of the womb, is the destruction of the ovum or embryo. If by accident or design the ovular membranes should become ruptured, gestation is arrested, and abortion necessarily ensues. At any period of pregnancy, therefore, a puncture through the membranes will sooner or later occasion the evacuation of the womb. (Ramsbotham's 'Obst. Med.,' p. 655.) This author remarks that the performance of the operation demands a most accurate knowledge of the anatomy of the ovum and the maternal structures, as well as of the state of development which the neck of the womb assumes at different periods of pregnancy. In medical practice, for the induction of premature labour, the membranes are ruptured either by the use of a catheter, or by an instrument of this shape, but including a blade like a tonsil-lancet. Unless the inner membrane or amnion be opened, gestation may still proceed, and abortion will not take place. When all the membranes are completely penetrated and the waters are discharged, uterine action is invariably induced, but the time which elapses from the performance of the operation to the commencement of labour is subject to great variation. Ramsbotham states that he has known the womb begin to act in *ten hours* after the rupture, but in another case a week elapsed before its action commenced. As a rule, uterine action is in general fully established in from fifty to sixty hours. In *Reg.* v. *Sharpe* (Notts Lent Ass., 1873), the prisoner, who was a charwoman, but said by profession to be an abortion-monger, was convicted of this crime. It was proved that she ruptured the membranes with an ivory crotchet-needle, and three days afterwards the woman was delivered of a still-born child. Another woman, proved to be an accessory to the act, was sentenced to fifteen months' imprisonment. ('Lancet,' 1873, i. p. 422.)

It must not be supposed, however, that, where a criminal intention exists, a long period is required for removing the contents of the womb. In a criminal attempt by a medical practitioner, in which the woman would be a consenting party to the act, the removal of the embryo or fœtus might be effected in a much shorter period of time than in those cases of obstetric practice in which there was no desire to expose the woman to the slightest risk, and premature labour was openly induced. At any rate, the time for the completion of abortion could not be measured by cases in which the womb has been left to undergo spontaneous contraction after the membranes had been punctured, and the waters had escaped. There would, however, be great danger to a woman in the necessary manipulations required. The reader will find reports by Tardieu ('Ann. d'Hyg.,' 1855, t. 1, p. 406) of numerous cases of abortion as a result of mechanical means applied to the womb; and some good practical remarks by the same writer, on the mode in which these inquiries should be conducted, in the 'Ann. d'Hyg.,' 1856, t. 1, p. 141. On the mechanical means for procuring abortion and the results, see a paper by Lex. ('Vierteljahrsschr. für Gerichtl. Med.,' 1866, 1, p. 253.)

It is obvious that this mode of perpetrating abortion is only likely to succeed in the hands of persons who have a complete anatomical knowledge of the parts. The death of the woman will convert the crime into murder, if instruments are introduced into her body by persons who are ignorant of anatomy. In *Reg.* v. *Heap* (Liverpool Lent Ass., 1875), it was proved that prisoner had caused abortion by the use of instruments, and this had led to the death of the woman. On an inspection, two sharply punctured wounds were found in the womb, and to these death was attributed. The prisoner, although not intending to destroy life, was convicted of murder. A midwife was convicted of a similar crime. (Manchester Wint. Ass., 1877, *Reg.* v. *Cartledge.*) The evidence showed that prisoner had introduced an instrument for the purpose of procuring abortion. Inflammation followed, and the woman died in three days from peritonitis and gangrene. In one case tried at Liverpool, a man procured abortion, and brought about the death of the woman, by driving a weaver's spindle into the womb, the fundus of which was completely transfixed, and a fatal peritonitis induced.

A method much resorted to in the metropolis is to rupture the membranes by the insertion of a piece of whalebone or wire into the mouth of the womb till blood appears. Pills of oil of savin, sulphate of iron, and aloès, are then freely given to aid in the expulsion of the ovum. A miscarriage is frequently brought about by the mere insertion of a male catheter, or bougie, between the membranes and the wall of the womb. Other means, such as tents and Barnes's bags, are also resorted to. The editor recently met in his practice with the case of a married woman on whom an unqualified medical man has successfully operated ten times. The same woman had also abortion successfully induced on her by a female abortionist. Happily, both the unqualified medical man and the female practitioner are now undergoing penal servitude.

It is to be regretted that members of the medical profession have on several occasions misused their professional knowledge, and have exposed themselves to prosecutions for this crime. Sometimes it is probable the charge has been raised falsely, or through misapprehension on the part of the woman; at others, the evidence has left it very clear that the charge was well founded. Of late years medical men have rather freely used the speculum. When this instrument has been improperly or unnecessarily used on a pregnant woman, a charge of attempted abortion by instruments may be easily raised against a medical practitioner. A trial took place (Exeter Lent Ass., 1854, *Reg.* v. *Griffin and Venn*) in which it was charged that the accused Venn (a surgeon) had feloniously used an instrument with the intent to procure the miscarriage of a woman. According to the evidence, Venn had on several occasions passed a round polished instrument into her body, once in a coppice and at another time in a field. The defence was that the surgeon had merely used a speculum to ascertain whether the girl was pregnant, in order to know how to prescribe for her; and that it was absurd to suppose that he had ever intended to procure abortion, for this had not followed, and it might have been easily produced by him at any period of pregnancy, if he had wished it. On this evidence the prisoners were acquitted. Admitting the statements of the girl and the prisoner to be correct, it may be remarked that medical practitioners, in the lawful exercise of their profession, do not commonly use a speculum in open fields or coppices to determine whether a woman is pregnant or not; and it is a well-known fact that a speculum is not necessarily required for determining the question of pregnancy.

Medicinal Substances. Emmenagogues. Ecbolics.—These are frequently resorted to for inducing criminal abortion; but they rarely answer the intended purpose, and, when abortion follows, it is often at the expense of the life of the woman. Mineral poisons have been ignorantly employed for this nefarious object, and often with a fatal result. Among these substances may be mentioned arsenic, corrosive sublimate, bichromate of potassium ('Vierteljahrsschr. für Gerichtl. Med.,' 1866, 2, p. 113), sulphate of copper, copperas or sulphate of iron, tincture of perchloride of iron, and other irritants. Metallic *mercury*, which is generally reputed to be innocent, has been given for the purpose of procuring abortion. In a case recorded by Gibb ('Lancet,' 1873, i. p. 339), it produced no effect on the womb, but caused some severe nervous symptoms, which would justify the application of the term 'noxious' to this substance.

The tincture of perchloride of iron (steel drops) has frequently caused severe symptoms, and seriously injured health, without producing abortion. In a case in which the author's evidence was required (Lincoln Sum. Ass., 1863, *Reg.* v. *Rumble*), it was proved that this compound of iron had been given in large doses daily to a pregnant woman, for the purpose of exciting abortion. It had not had this effect, but it had seriously injured the health of the woman. The prisoner also gave to her cantharides in pills. The defence was that these were proper medicines for the treatment of amenorrhœa, under which, it was alleged, she was labouring. The large doses administered, and the secrecy with which the medicines were supplied, proved that they had been given unlawfully, and with criminal intent; and the chemist who supplied them, knowing the purpose for which they were required, was convicted. In 1878, a chemist pleaded guilty, on the analyses of the editor, of administering large doses of tincture of iron and aloes to a woman, with the view of procuring abortion. The method failed, and the woman was afterwards operated on by a qualified medical man, with fatal result. (*Reg.* v. *Darnley and Moon*, Lewes Sum. Ass., 1878.)

Arsenic, corrosive sublimate, and other mercurial compounds may cause death, without in any way exciting the womb to expel its contents. In July, 1845, a woman who had passed the fifth month of her pregnancy, took a large dose of arsenic, as it was alleged, for the purpose of abortion. She died in less than seven hours, having suffered during that time from severe vomiting and purging; yet abortion did not take place. Such powerful poisons as strychnine have failed to effect it. A girl, æt. 17, who was pregnant, swallowed the contents of a packet of Battle's vermin-killer. The usual symptoms followed, with tetanic spasms and opisthotonos. She recovered, and went her full time without aborting.

Drugs, such as croton-oil, elaterium, gamboge, colocynth, hellebore, and other drastic purgatives, have been used with criminal intent without causing abortion. Aloes and two of its compounds, *hiera picra*, a mixture of aloes and canella bark, and *Pilacotia* (*pilulœ cocciœ*), sometimes called 'pill cochia,' a mixture of aloes and colocynth, are much used as purgatives among the poor. In large or repeated doses, they are supposed to have the power of exciting the womb, and are secretly employed for the purpose of abortion. Although not poisons in the strict sense of the word, it may be observed of these drugs, and of all purgatives which cause much straining, or specially affect the rectum, that they may readily bring on abortion in the advanced stages of pregnancy, while they fail in the earlier stages. The herbs which have acquired a popular repute as abortives, in the form of powdered leaves, infusion, or decoction, are very numerous. Some are innocent—such as pennyroyal, broom, and fern; others are pernicious—such as white and black hellebore, yew, and laburnum. A decoction of broom simply acts as a diuretic.

The medicinal substances above described, if they have any effect, exert an indirect action on the womb by producing a shock to the general system. But there is another class of bodies which are considered to act on the womb directly. These are classed under the names of *emmenagogues* and *ecbolics*. As in trials for criminal abortion some confusion has arisen in the application of these terms (see *Reg.* v. *Wallis*, Winchester Sum. Ass., 1871), it will be necessary to state here what is understood by them. *Emmenagogues* (from ἐμμήνια, the menstrual discharge, and ἀγωγός, exciting) signify those medicines which excite or promote the menses. Pereira enumerates among these savin, black hellebore, aloes, gamboge, rue, madder, stinking goosefoot (*Chenopodium olidum*), gin, borax, and for the most part substances which when taken in large doses act as drastic purgatives or stimulating diuretics. When amenorrhœa coexists with anæmia, the most effectual emmenagogues are chalybeates, the preparations of iron, including compound iron or Griffith's mixture. *Ecbolics* (from ἐκβόλη, expulsion), substances which cause the expulsion of the fœtus, imply medicines which operate directly as *abortives*. They excite uterine contractions, and thereby promote the expulsion of the contents of the womb, such as the fœtus, the placenta, hydatids, clots of blood, &c. The number of ecbolics known is very small. Indeed, the only known unequivocal agent of this kind is *ergot*. The ergot in ordinary use is that of rye; but the ergot of wheat is said to be equally effectual, and the same perhaps may be stated of the ergots of all grasses.

Tincture of cotton-wood bark is also a reputed abortifacient, or ecbolic, and has the repute of being commonly used for purposes of abortion by the blacks of the United States. Its use has been a matter of investigation in one criminal trial in this country. (*Reg.* v. *Hardie*, C. C. C., Dec. 1883.) Black snake-root (*Actæa racemosa*) is also another ecbolic of some repute.

In addition to these, there are other substances derived from the vegetable, animal, and mineral kingdoms which have been employed for procuring abortion, and on the specific effects of these agents when administered to pregnant women medical opinions may be required. Such are yew leaves, grains of paradise, tansy, hellebore (white and black), squills, pennyroyal, cantharides, sulphate of potassium, borax, Griffith's mixture, and iron filings. The English herbs on which medical opinions may be required are chiefly rue, pennyroyal, savin, and tansy.

Rue (*Ruta graveolens*).—This common garden plant has been much used in the form of decoction. Tardieu has reported three cases in which a strong decoction of rue produced abortion at the fourth, fifth, and about the sixth month of pregnancy respectively, and the women recovered. ('Ann. d'Hyg.,' 1855, t. 1, p. 403.)

Pennyroyal (*Mentha pulegium*).—This is a variety of mint. The infusion, under the name of pennyroyal tea, or pennyroyal water, is used as a popular remedy for obstructed menstruation, and it has also been used for the purpose of abortion; but it has neither emmenagogue nor ecbolic properties, and it is not now employed for any purpose by medical practitioners. Any notice of this substance here would have been quite unnecessary, but for the fact that in a trial for criminal abortion (*Reg.* v. *Wallis,* 1871), strongly abortive properties were incorrectly assigned to it; and it was described as a highly noxious substance. Pennyroyal infusion or tea has no more effect on the womb than peppermint, spearmint, or camphor water. A medical witness at the trial above referred to stated that pennyroyal would produce abortion, but admitted in cross-examination that he had had no practical knowledge of its properties, and, unless taken for some time and of considerable strength, it would have no effect.

Medical witnesses should be more cautious in giving evidence on these occasions in reference to the properties of drugs. They have to consider seriously, in all cases of alleged criminal abortion by drugs, whether the substance is noxious—whether it is an emmenagogue or really an ecbolic. They should base their opinions either on actual personal experience or on the authority of those who have practically studied the effects of the drugs, otherwise the court may be greatly misled, as in the case of *Reg.* v. *Wallis,* in placing the facts before the court. Pennyroyal is not described by any authority as an emmenagogue or ecbolic, or as a substance having any abortive or noxious properties.

Savin (*Juniperus sabina*). *Oil of savin.*—The properties of this substance as a vegetable irritant poison have been elsewhere described (*ante,* p. 147). Writers on Materia Medica ascribe to it emmenagogue properties, *i.e.* that it is an excitant to the blood-vessels of the womb, and is useful in certain cases of disordered menstruation, but it does not excite uterine contractions like the ergot of rye, and it is not used for the purpose of aiding parturition. It should not be given to a woman in the pregnant state, for its operation as an irritant might affect the womb indirectly and lead to abortion. It has been long known and employed as a popular abortive, the tops being used in the form of infusion or decoction, or the oil is given to aid instrumental interference. (*Reg.* v. *Phillips and Cayley,* C. C. C., Feb. 1885.) Under these circumstances, it commonly acts only as an irritant poison, causing severe pain, with vomiting and purging. One case of its fatal action when used for procuring abortion was referred to the author in 1845. ('Lond. Med. Gaz.,' xxxvi. p. 646.) A woman may die undelivered, or the fœtus may be expelled dead, and the woman afterwards die from the irritant effects produced on the stomach and bowels. The powdered leaves of this plant are frequently employed as a popular abortive; they are readily obtainable in gardens. They may be given in the form of infusion or decoction. The former is the most powerful. Savin may also be given as a tincture or as an essential oil. In any of these forms, when given in large or frequently repeated doses, it has an irritant action. The powdered leaves are not used in medical practice. The dose as an emmenagogue would be from five to fifteen grains—the medicinal dose of the oil is from two to six minims, and of the tincture (*Tinctura sabinæ,* B.P.) from twenty minims to one fluid drachm. This holds the oil and resin dissolved. The leaves of savin may be identified by their peculiar odour when rubbed, and also by their appearance under the microscope (see *ante,* p. 147).

Reported cases in which the oil of savin has been administered for the purpose of abortion are not very common. In *Reg.* v. *Pascoe* (Cornwall Lent Ass., 1852), a medical man was convicted of administering oil of savin to a woman with intent to procure miscarriage. The proof of intent rested partly on medical and partly on moral circumstances. It appeared that the prisoner had given fourteen drops of the oil, divided into three doses, daily—a quantity which, according to the medical evidence at the trial, was greater than should have been prescribed for any lawful purpose. The medicinal dose, as an emmenagogue, on the authority of Christison, is from two to five *minims*, and according to Pereira from two to six *drops*. The quantity given by the prisoner, although a full dose, was not, therefore, greater than these authorities recommend; and his criminality appears to have rested, not so much on the doses given, as on the question whether he knew or, as a medical man, had reason to *suspect* that the woman for whom he prescribed it was pregnant. No medical authority would recommend oil of savin in full doses for *pregnant* women; and with regard to the existence or non-existence of pregnancy in a special case, medical men are reasonably presumed to have better means of satisfying themselves than non-professional persons. The prisoner's innocence, therefore, rested on the presumption that he implicitly believed what the woman told him regarding her condition; that he had no reason to *suspect* her pregnancy, and therefore did not hesitate to select and prescribe a medicine which certainly has an evil reputation, and is rarely used by regular practitioners. According to the evidence of the woman, she informed the prisoner that she had disease of the heart and liver, and that nothing more was the matter with her. It is absurd to suppose that oil of savin would be prescribed by a medical man for such a disease as this. The prisoner, on the hypothesis of innocence, must have intended that the medicine should act on the womb, and must have inferred the existence of an obstruction to menstruation from natural causes irrespective of pregnancy. The jury do not appear to have given him credit for such ignorance of his profession, and this probably led to his conviction. There can be no doubt that the oil was administered with a guilty intention. Every qualified practitioner, acting *bonâ fide*, would undoubtedly satisfy himself that a young woman whose menses were obstructed, was *not pregnant* before he prescribed full doses of this oil three times a day, or he would fairly lay himself open to a suspicion of criminality. If pregnancy—a frequent cause of obstructed menstruation—were only *suspected*, this would be sufficient to deter a practitioner of common prudence from prescribing, in any dose, a drug which may exert a serious action on the uterine system. ('Med. Times and Gaz.,' 1852, i. p. 104.) On the Northern Circuit, Dec. 1853 (*Reg.* v. *Moore*), a man was convicted of administering oil of savin to a pregnant woman. It made her very ill, but did not produce abortion. (See also *Reg.* v. *Phillips and Cayley*, C. C. C., Feb. 1885.)

The *oil of savin* is obtained by the distillation of the tops, in the proportion of about 3 per cent. by weight. It has a yellowish colour, and the peculiar terebinthinate odour of the plant, by which alone it may be recognized. It may be separated from the contents of the stomach by agitating them in a bottle with their volume of ether, in which the oil is very soluble. The ether may be afterwards removed by distillation. The odour of the oil has been perceived after death in the blood and in the cavities of the body. This may be regarded as a test of its presence. ('Vierteljahrsschr. für Gerichtl. Med.,' 1866, vol. 1, p. 241.) The oil of savin forms a turbid mixture with rectified spirit of wine. When treated with an equal volume of sulphuric acid, it acquires a dark-brown colour; and when this mixture is added to distilled water, a dense white precipitate is separated.

Tansy. Oil of Tansy.—Hartshorne states that in the United States the *oil of tansy* has acquired the character of a popular abortive, and has caused death in several instances. In England this oil and the herb have been chiefly employed for the purpose of expelling worms.

Saffron in the form of a decoction of the dried stigmas of saffron (*Crocus sativus*) has been used as a popular abortive. Thomsen has reported a case in which abortion occurred in a woman who had taken repeated doses of a decoction of saffron with starch. There was reason to believe, however, that manipulations *per vaginam* had also been resorted to, and these may have had the principal share in bringing about the result. ('Vierteljahrsschr. für Gerichtl. Med.,' 1864, ii. p. 315.) According to Pereira, although saffron was formerly used as an emmenagogue to promote uterine contractions, it is not established by any trustworthy observations that it possesses any medicinal properties. In modern medicines its chief use is to give colour and flavour to liquids.

Specific Abortives. Ecbolics. Ergot of Rye. Spurred Rye (*Secale cornutum*).—The substance called *Ergot* is a diseased growth on the grain or seed of rye, caused by a parasitic fungus. In powder, infusion, or tincture, it has been for some time used by medical practitioners to excite the action of the womb and aid parturition. It is also used for a similar purpose on animals in veterinary practice. The properties of ergot as an abortive are well known, and it is often criminally administered by midwives to pregnant women. In one case it was proved that it had been supplied in large quantities to a midwife, and further, that the death of a pregnant woman from hæmorrhage had been accelerated by the use of large doses of this drug. ('Pharm. Jour.,' Dec. 28, 1878, p. 541.) A trial which took place (*Reg.* v. *De Baddeley and wife*, C. C. C., July, 1871) shows also that 'herbalists' and 'spiritualists' are well acquainted with the properties of ergot as an abortive, and are ready to supply it in secrecy. The prisoners in this case were indicted for unlawfully supplying a certain noxious drug—namely, ergot of rye, knowing that it was intended to procure abortion. They inserted an advertisement in a spiritualistic journal, inviting people to consult at that house 'Madame de Baddeley, the celebrated clairvoyante.' From what was alleged to be transacted there, the police were induced to send a woman to consult the prisoners, and to concoct a story which might elicit their 'spiritual' mode of procedure. After being put into a state of so-called 'clairvoyance,' the female prisoner advised the applicant what to do in the case of a young woman whom she had mentioned, and gave her a quantity of ergot of rye to procure abortion. In all, 6*l.* were paid to the prisoners. The drug was at once handed over to the police. They were found guilty.

Ergot of rye has been found to bring on contractions of the womb at an advanced stage of gestation, or when efforts at parturition had already commenced. There is, however, some difference of opinion respecting its specific ecbolic properties. According to Lee, it has no effect in the *early* stages of gestation, although given in large doses. ('Lond. Med. Gaz.,' vol. xxv. p. 10; see also 'Edin. Med. and Surg. Jour.,' vol. liii. p. 27.) Kluge found that its properties varied according to whether it was gathered before or after harvest; in the former case it had an energetic action, while in the latter it was powerless. Beatty states that when used in obstetric practice it is liable, by absorption into the system of the mother, which may take place within two hours, to endanger the life of the child. ('Dub. Med. Jour.,' May, 1844, p. 202.) This question was referred by the French Government to the Academy of Medicine in 1845, as there was reason to think that, under its employment in the practice of midwifery, children were frequently born dead. ('Ann. d'Hyg.,' 1846, t. 1, 204; see also 'Lond. Med. Gaz.,' vol. xlvi. p. 680.) In confirmation of Beatty's statement, M'Clintock and Hardy report that out of thirty cases in which it was administered, twenty children were born dead. ('Practical Observations,' p. 95.) Ramsbotham considered that the drug might operate fatally on a child, according to the circumstances under which it was administered; but that, unless it excited the expulsive action of the womb, it had no effect on the child's system. (Op. cit., p. 319; also cases by Paterson, 'Edin. Med. and Surg. Jour.,' vol. liii. p. 142.) According to Millet, in commenced or imminent parturition, ergot procures a safe and prompt termination; and he never met with a case in which it injured the child. ('Med.-Chir. Rev.,' 1855, ii. p. 41.) This is also the result of the experience of Uvedale West, contained in a paper read before the Obstetrical Society (July, 1861). Between Dec. 1855 and June 1861 he had attended 734 labours, in 172 of which ergot was given. Including one case of twins, 173 children were born under the effects of ergot, of which number only five were still-born. These facts appear to show that ergot, as a rule, does not exert those noxious effects on the child which have been attributed to it by some obstetric writers.

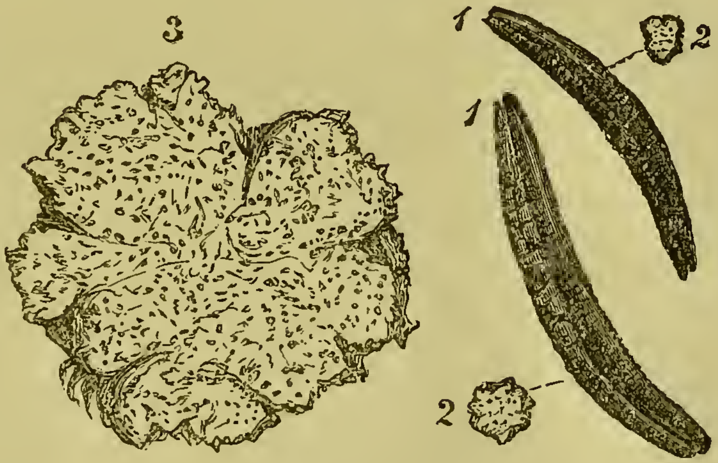
On trials for criminal abortion perpetrated or attempted, a medical witness must be prepared for a close examination on the ecbolic properties of the ergot of rye on the womb, as well as its general action as a poison on the woman and child. A case which occurred some years since (*Reg.* v. *Calder*, Exeter Lent Ass., 1844) has been reported, with comments on this subject, by Shapter. ('Prov. Med. Jour.,' April 10, 1844.) It was alleged on this occasion that savin, cantharides, and ergot had been respectively given by the prisoner, a medical man, for the purpose of procuring miscarriage. The woman on whose evidence the case rested was of notoriously bad character, and the prisoner was acquitted. There were three medical witnesses, who agreed that savin and cantharides were only likely to occasion abortion indirectly, *i.e.* by powerfully affecting the system—the view commonly entertained by professional men. Some difference of opinion existed with regard to *ergot*, but the balance of evidence was decidedly in favour of its specific action as a direct uterine excitant; and, according to Griffiths, this is so well known to the inhabitants of the United States, that it is there in frequent use as a popular abortive.

A case occurred at Brighton in 1864, in which a question arose respecting the fatal effects of this drug on a woman who had taken it for a long period, obviously with a view to procure abortion. She died, however, without abortion having taken place; and the question at issue was whether this drug had or had not caused her death. The dose taken was about a teaspoonful of the tincture of ergot three times a day for a period of eleven weeks. On inspection, patches of inflammation were found on the mucous membrane of the stomach after death. No other cause for death was apparent, and one medical witness assigned it to the poisonous irritant action of the ergot, as, at the early stage of pregnancy which she had reached (the third month), this substance would not be likely to act as an abortive. Another medical man who gave evidence at the inquest asserted that death could never be primarily caused by ergot of rye. The qualification introduced into this medical opinion is of small importance. The deceased woman is reported to have taken a large portion of the tincture, and it is quite immaterial whether the drug killed her by a primary or secondary operation. Tardieu describes the case of a woman, æt. 24, who aborted in the fourth month of pregnancy, as a result of the administration of ergot in powder: she died from peritonitis in about twenty-four hours. Ergot was found in fragments in the lower third of the bowels. ('Ann. d'Hyg.,' 1855, t. 1, p. 404.) At the same time, he states that, in his opinion, ergot of rye has no direct action as an abortive; in fact, that is it not an ecbolic. ('Ann. d'Hyg.,' 1865, t. 1, p. 139.) The numerous cases showing its efficacy, and its extensive use in midwifery practice, are sufficient to prove that this opinion is not borne out by facts. In respect to its operation, it may be observed that the effects produced by its administration are not such as readily to excite suspicion. It does not cause the decided symptoms of irritation observed in the action of savin, nor the nervous symptoms which are usually produced by rue. In medicinal doses, given at proper intervals, the only marked effect which it produces on a pregnant woman is a lowering of the pulse. Sometimes other symptoms of a severe character have presented themselves. ('Ann. d'Hyg.,' 1856, t. 1, p. 140.) If a person dies from the effects of this drug, the results are legally the same, whether its operation as a noxious substance is of a primary or secondary kind. It must be borne in mind that ergot is largely used in medical practice to check hæmorrhage.

Action of Ergot. Doses. Analysis.—In doses of from half a drachm to two drachms, ergot in powder has caused nausea, vomiting, dryness of the throat, great thirst, aversion from food, pain in the abdomen, slight purging, pain in the head, stupor, and dilatation of the pupils. (Pereira.) The medicinal dose of the powder in uterine diseases is from 5 to 15 grains. It is employed in a larger dose (from 20 to 60 grains at intervals of half an hour) to excite uterine action either for abortion or parturition. The dose of the tincture is one drachm (a teaspoonful); this is equivalent to 15 grains of the powder. The dose of the ethereal tincture, when employed for the purpose of exciting uterine action, is one drachm every half-hour for three or four doses. Ergot must be regarded as a noxious substance, and by some authorities it is ranked among narcotico-irritant poisons. Under the Pharmacy Act, 1868, it is placed in the first part of the schedule of poisons, and can only be sold under certain restrictions, with the word 'Poison' attached to it. It does not easily cause death in one large dose, but its fatal operation appears to be more strikingly developed by its long-continued use in small or medicinal doses.

Kobert, a recent authority, states that the ecbolic (uterine) action of ergot is caused by *Sphacelinic acid*, interspersed perhaps by an alkaloid, *Cornutine*. ('Pharm. Centralhalle,' Dec. 25, 1884; 'Pharm. Jour.,' Feb. 21, 1885, p. 676.) Others have ascribed its effect to an oil; and the action has also been assigned to *Ecboline*, an alkaloid, and also to *Ergotine*.

Fig. 49.



The Ergot of Rye.

The form and characters of the ergot in mass are well known to professional men. It consists of grains varying in length from half an inch to an inch and a quarter, and the breadth of about the eighth of an inch. The grain is cylindrical, blunt at the ends, and curved like the spur of a cock. The outer coat is of a dark purple colour, almost black, irregularly fluted on the surface, which is often cracked and fissured. In the above illustration (Fig. 49), 1, 1, represent the ergot of rye as it is usually seen. The smaller of the two grains represents the average size; 2, 2, are sections of the grains; and 3 represents a transverse section magnified thirty diameters. The spongy character of the substance of the ergot is here more distinctly seen.

The powder of ergot has a faint fishy odour of trimethylamine; this is especially observed when it is rubbed with a solution of potash.

This alkali dissolves the powder in part, and the solution acquires a dingy-red colour. In the form of tincture, alcoholic or ethereal, the peculiar fishy odour of the extract when treated with potash is well marked. It may, however, be concealed by other odours. Sometimes small particles of ergot, presenting a pink-red colour in the dark external coat, may be detected in the sediment by the microscope. When ergot has been taken in powder, fragments of it may be found scattered over the lining membrane of the stomach or bowels; these may be identified by the characters above described. The ethereal tincture of ergot, evaporated to an extract, yields a yellowish-coloured oil, which, if any of the colouring matter of ergot is present, acquires a reddish colour when heated with a solution of potash.

In examining the body of a person to whom ergot is alleged to have been given, the medical jurist must rely upon the physical properties of the fungus if he can obtain any of it.

Local Applications. Injections.—In a case which occurred in France, it was proved that abortion had been caused by the injection of some corrosive and irritating substance into the vagina. The genital organs, as well as the abdominal viscera, were found in a high state of inflammation. ('Lond. Med. Gaz.,' vol. xxxvii. p. 171.) This is a mode of perpetrating the crime which can hardly escape detection. An analysis of the tissues might be required, in order to determine the nature of the substance used. It appears from a trial that this mode of attempting to procure criminal abortion has been the subject of a prosecution in this country. It was established by the medical evidence that some liquid was injected into the vagina by a syringe, but there was no proof of the nature of this liquid; and as it was not shown to be of a *noxious* nature, the judge who tried the case directed an acquittal. (York Sum. Ass., 1853; 'Lancet,' 1853, ii. p. 89.) It is proper to state, however, that the mere mechanical effect of an innocent liquid, frequently applied, may be more effectual in producing abortion or premature labour than the use of any irritating liquid. In medical practice tepid water has been employed as an injection for the purpose of inducing premature labour in advanced pregnancy. Lazarewitch has published twelve cases in which the injection of water at 95° F. caused the womb to contract and expel its contents. ('Trans. Obst. Soc.,' vol. ix. p. 161.) The earliest period at which Lazarewitch employed water, was in the thirtieth week of pregnancy. In most of the cases, the women had reached the thirty-sixth week of pregnancy. This is much later than the usual period at which abortion is commonly attempted for criminal purposes, namely, about the twenty-eighth week. At the same time, it proves that an innocent injection may be used to produce abortion, and, according to the judicial decision above given, the use of such a liquid would not render a person criminally liable. The words of the statute, however, 'other means whatsoever,' appear sufficiently comprehensive to include the use of a non-noxious liquid, and, according to a judicial opinion given in one case (*Reg.* v. *Wallis*, p. 554, *post*), it is not material to prove that the liquid employed is of a 'noxious' nature. In general, when the criminal means taken to procure abortion are effectual in causing the expulsion of the child, it comes into the world dead; but it may be born alive and die after its birth. Under these circumstances, although no violence is applied directly to the body of the child, but its death is simply the result of immaturity or the feeble state in which it was born, the person causing such abortion might render himself liable to an indictment for murder.

Signs of Abortion in the Living and Dead.—These are practically the same as those elsewhere described as the signs of delivery. (See *ante*, pp. 521, 528.) The examination may extend to the woman, either living or dead. In the former case, there will be some difficulty, if the abortion has occurred at an early period of gestation, and several days have elapsed before the examination is made; in the latter case, the investigation is not always free from difficulty. Shortt, who has had much experience on this subject, thus summarizes the symptoms which he met with in numerous cases which came before him officially. In the Madras Presidency alone there were 306 cases in two years. In the cases which he examined up to a fortnight, or a little later, after the abortion, the vulva and passages were relaxed, the mouth of the womb patulous, and in the early stage there was a lochial secretion, replaced in later cases by a white mucous secretion, having the peculiar smell common to women in the puerperal state. Among other symptoms, were a distension of the breasts, a flow of milk on pressure, and a knotty feeling in them. There was a general anæmic or bloodless condition of the body, with sunken eyes, an excited pulse, and dry skin. In multiparous women, the womb was more patulous, and the neck was not distinguishable; but in primiparous women the mouth of the womb, although patulous to a small extent, still had the neck protuberant. ('Obst. Trans.,' vol. ix. p. 9.)

It is believed by many physiologists that menstruation is a state in some measure vicarious to conception, and the appearances presented by the generative organs during the menstrual period are somewhat similar to those which are observed after conception in its early stage. Whitehead remarks that in women who died while the menses were flowing, the uterine walls were thickened and spongy, and the mucous lining was more or less swollen and suffused. The neck and lips of the womb were swollen, the orifice was open, and the vaginal membrane and clitoris involved in the increased action. One of the ovaries was found larger and more congested than usual, presenting evidence of the recent escape of an ovum (p. 529, *ante*). Unless these facts are attended to, an examiner may form an erroneous opinion respecting the chastity of a deceased woman. (For the mode of conducting the examination of the woman, and of the embryo or fœtus in cases of abortion, see 'Ann. d'Hyg.,' 1856, t. 1, pp. 149, 153.)

Important questions may arise when it is alleged that abortion has been caused by the use of instruments, and death is referred to peritonitis, as the result of their employment. In these cases a medical opinion should not be based upon the statements either of the woman or of her friends, but upon some distinct and satisfactory medical proofs that mechanical violence has been done to the womb, its contents, or its appendages. Peritonitis, or inflammation of the lining membrane of the abdomen, may arise from a variety of causes. If we assign it to a particular cause, and thus implicate another in a felonious charge, we should do this only upon *medical* facts obtained by an examination of the dead body; we should deal with such cases as if we knew nothing of their previous history.

A druggist was charged with using instruments to cause abortion, which had led to the death of a woman from peritonitis. It appeared also that he had given to her doses of tincture of perchloride of iron. The woman was delivered of a dead fœtus at about the fifth month, and she herself died shortly afterwards. There was nothing in the body of the woman or of the fœtus to show that instruments had been used, but it was quite clear that peritonitis was the cause of death. One medical witness thought that an operation had been performed on her body, but it was admitted that peritonitis might arise from a variety of causes in a woman who had had a miscarriage. ('Pharm. Jour.,' 1871, p. 256.) On the diagnosis of abortion and its causes, see a paper by Lex. ('Vierteljahrsschr. für Gerichtl. Med.,' 1866, 1, 179.)

Feigned Abortion.—For various motives, into the consideration of which it is unnecessary to enter, a woman may charge another with having attempted or perpetrated the crime of abortion. Such a charge is not common, because, if untrue, its falsity may be easily demonstrated. A young woman in Guy's Hospital, in 1846, charged a policeman (who, according to her statement, had had forcible intercourse with her) with having given her some substance to produce abortion, and having subsequently effected this mechanically. She was not examined until nearly two months after the alleged perpetration of the crime, when Lever found that there was no reason to believe that she had ever been pregnant. This was a case of feigned abortion. When charges of this serious kind are brought forward, they are always open to the greatest suspicion, unless made immediately after the alleged attempt, as it is then only that an examination can determine whether they are true or false. If so long delayed as in this instance, without any satisfactory reason, the presumption is that they are false.

Legal Relations.—In the statute for the consolidation of the criminal law (24 & 25 Vict., c. 100, ss. 58 and 59), the nature of this crime, and the medical proofs required to establish it, have been more explicitly stated than in former Acts. By s. 58 (on attempts to procure abortion) it is enacted that 'Every woman *being with child*, who, with intent to procure her own miscarriage, shall unlawfully administer to herself any poison or other noxious thing, or shall unlawfully use any instrument or other means whatsoever with like intent, and whosoever, with intent to procure the miscarriage of any woman, *whether she be or be not with child*, shall unlawfully administer, &c., shall be guilty of felony.' As in every case a woman must be accessory to this crime upon herself, it leads to the difficulty that her evidence, uncorroborated by circumstances, may not be received by the court.

In two cases tried at the Lewes Sum. Ass., 1878 (*Reg.* v. *Brown*), the woman charged with this crime was acquitted under the direction of the judge, because there was no corroboration of the evidence of the two women on whom the crime had been perpetrated. In one, the drugs prescribed by the prisoner produced no effect; she went her full time, and was delivered. In the other case, the woman was so ill that she could not appear as a witness, and it was admitted by counsel that he could not corroborate the evidence of either.

It will be observed that the *means* employed, whatever their nature, must have been used with an *intent* to procure the miscarriage of a woman—a point which will be sufficiently established by a plain medical statement of the means employed. Supposing that a drug has been used, the witness may be further required to state whether it is 'a poison or other *noxious* thing.' We must refer the reader to what has been said elsewhere (*ante,* p. 47), in order that he may be able to judge how far the substance administered would fall under the description above given. Whether the substance would or would not have the effect intended, *i.e.* of inducing abortion, is immaterial.

Noxious Substances.—Is it necessary to prove that the substance procured or administered is of a noxious nature? Some uncertainty may exist as to the strict meaning of the word 'noxious.' All will allow that the word implies something injurious to the body, but a difference of opinion may arise among medical witnesses with respect to its application to the substance under discussion—as, for example, with respect to rue or savin. A substance must be regarded as injurious to the body, or noxious, either according to the form, quantity, or frequency with which it is administered. Savin, ergot, and rue are irritant; and they become noxious when given in large doses, or in small doses frequently repeated. Aloes and castor-oil are innocent when taken in small doses; but they acquire noxious or injurious properties when administered frequently, or in large quantity, to a pregnant woman. To confine the term 'noxious,' therefore, to what is strictly speaking a poison *per se*, would be giving a latitude to attempts at criminal abortion which would render the law inoperative. (*Reg.* v. *Stroud*, Abingdon Sum. Ass., 1846.) The small quantity of the substance taken at once does not affect the question, provided the dose be frequently repeated. A case in which the author was consulted by Reynolds was tried at the Exeter Wint. Ass., 1844. Two powders, weighing each one drachm, were prescribed by a prisoner; one consisted of colocynth, the other of gamboge, and with them was half an ounce of a liquid (balsam of copaiba). They were to be mixed together, and a fourth part to be taken four mornings following. Reynolds said, in answer to the question whether such a mixture was noxious or injurious, that each dose would be an active purgative, and might thereby tend to excite abortion. One dose would not be productive of mischief in a healthy countrywoman, but its frequent repetition might lead to serious consequences in a pregnant woman. In another trial (*Reg.* v. *Whisker*, Norwich Lent Ass., 1846), it was proved that the prisoner had caused to be taken by a woman a quantity of *white hellebore* in powder, for the purpose of procuring abortion. One medical witness said he considered hellebore to be noxious to the system, but he knew of no case in which it had produced death; and, under these circumstances, he did not consider himself justified in calling it a poison. Another medical witness stated, in his opinion, it belonged to the class of poisons. The judge, in summing up, told the jury that *that* was to be regarded as a poisonous drug which, in common parlance, was generally understood and taken to be such; and he thought the medical evidence sufficiently strong to bring hellebore within the meaning of the statute. The jury found the prisoner guilty, alleging that in their belief white hellebore was a poison. ('Lond. Med. Gaz.,' vol. xxxvii. p. 830.) The only circumstance calling for remark in this case is that any doubt should have been entertained by a medical practitioner respecting the poisonous properties of white hellebore. It is a powerful vegetable irritant, and has caused death in several instances.

Medical proof of the nature of the substance administered, and that it was *noxious*, was formerly required on these occasions. In *Reg.* v. *Taylor* (Exeter Wint. Ass., 1859), some powders had been given by the prisoner to a girl with a view of inducing abortion. No portion of the powders could be obtained for examination; but two medical gentlemen who heard the evidence deposed that in their opinion the powders were of a noxious nature. In the defence, it was urged that this had not been proved by a chemical analysis. The jury adopted this view, and returned a verdict of acquittal. In *Reg.* v. *Wallis* (Winchester Aut. Ass., 1871; see p. 550, *ante*), Brett, J., in addressing the grand jury, called their attention to the words of the statute, which declares that where any person shall unlawfully administer a poison or some other noxious thing, or shall unlawfully use any instrument or other means whatsoever, with intent to procure miscarriage, he shall be guilty of felony, and said that, having regard to the words 'other means whatsoever,' though there might be some doubt as to the construction of the statute, he should direct that in one count of the indictment the word 'noxious' should be omitted, and he should hold that, if the person accused did administer some drug or something which he thought would procure miscarriage with that intent, although the thing itself would not procure that miscarriage, he would nevertheless be guilty of the offence, and they ought to find a true bill. According to this judicial dictum, it would appear that it is not in all cases necessary to prove by medical evidence that the substance procured or administered was of a noxious nature. The words of s. 59, as to procuring a noxious thing, or any instrument or 'thing whatsoever,' strictly interpreted, would include all substances, noxious and innoxious. If this view be generally adopted, medical evidence will be much simplified. Counsel will not be under the necessity of cross-examining medical witnesses on the strict meaning of the word 'noxious.' In *Reg.* v. *Wallis*, the substances procured by the accused were not noxious, but the jury acquitted the prisoner apparently on the ground that he did not actually administer the drugs: hence the question of noxiousness did not formally arise. From the ruling in this case, it would appear that if a person procured or administered castor-oil or camphor-julep, with intent to procure miscarriage, and with a belief that the substance would produce it, he would be found guilty of the offence. This being so, the use of the words 'poison' and 'noxious thing' in the statute is surplusage, and tends only to cause confusion in the medical evidence.

In *Reg.* v. *Newton* (Lewes Sum. Ass., 1873), it was proved that the prisoner had given to a girl who was pregnant by him some pills and a powder, which made her very sick. A witness was called, who described himself as a labouring man, and stated that the prisoner obtained the medicine from him, that he had taken some of the pills himself, that they were antibilious pills, and that the powder was rhubarb. Under these circumstances, counsel for the defence submitted that there was no evidence that the medicine administered was 'a noxious thing' within the meaning of the statute which created the offence, citing the case of *Reg.* v. *Isaacs*, 32 'Law Jour.,' M.C. Martin, B., however, overruled the objection, and the prisoner was found guilty. A much stricter meaning is attached to the word 'noxious' by judges when the substance has been given for procuring abortion, than where the intention has been to aggrieve or annoy, under the statute on poisoning. (See *Reg.* v. *Hennah*, Cornwall Lent Ass., 1877.) In this case, cantharides were held *not* to be noxious unless administered in a *quantity* to produce certain effects on the body.

In reference to the medical proofs of this crime, it is not required that any specific injury should have been done to the woman, or that abortion should have followed, in order to complete the offence. It is not even necessary to prove that she was with child, or that the aborted substance was a fœtus or child. It might be a mass of blood, a mole, or a group of hydatids. The crime is frequent, but its perpetration is secret. Applications are frequently made to medical men and druggists by the lower class of people for drugs for this purpose; the applicants appear to have no idea of the criminality of the act. Under the name of 'female pills' or 'drops,' medicines are thus dispensed in secrecy, and those who supply, as well as those who receive them, appear to have no idea that they are exposing themselves to a criminal prosecution. In one case a bottle containing a liquid supposed to have been used for the purpose of abortion was sent to the author for examination. It was labelled 'Persian Otto of Roses.' It contained a strong ethereal tincture of ergot of rye.

On one trial for criminal abortion, the medical evidence went far beyond its customary boundary. It appeared that the prisoners had applied to a medical man to supply them with drugs for procuring abortion. The medical man, mistaking his duty under such circumstances, gave information to the police, and, acting under their advice, supplied some drug which could do no injury. The prisoners were thus led to the commission of a felony, and at the trial the medical man appeared in the capacity of informer as well as expert—a circumstance which led to some severe observations from the judge. When such an application is made to a professional man, there is no objection to the fact being made known to the police or magisterial authorities, but beyond this he should not go. He should refuse to supply the applicants with drugs or lend himself in any way as a detective for the purpose of a prosecution. The act was no doubt done with a good intention to protect the public, but under a mistaken sense of duty.

On inducing Premature Labour. Medical Responsibility.—It may be proper to offer here a few remarks upon the common practice of inducing *premature labour*, as, *e.g.* in certain cases of disease, of deformity of the pelvis, and in cases of excessive vomiting from pregnancy. This practice has been condemned as immoral and illegal; but it is impossible to admit that there can be any immorality in performing an operation to give a chance of saving the life of a woman, when, by neglecting to perform it, it is almost certain that both herself and the child will perish. (See, on the morality, safety, and utility of the practice, Ramsbotham's 'Obst. Med.,' p. 315.) Any question respecting its illegality cannot be entertained; for the means are administered or applied with the *bonâ fide* hope of benefiting the female, and not with any criminal design. It is true that the law makes no exception in favour of medical men who adopt this practice, nor does it in the Statute on Wounding make any exceptions in favour of surgical operations; but that which is performed *bonâ fide* would not be held to be unlawful. The necessity for the practice ought to be apparent: thus, for instance, it should be shown that delivery was not likely to take place naturally without seriously endangering the life of a woman. It is questionable whether, under any circumstances, it would be justifiable to bring on premature expulsion, merely for the purpose of attempting to save the life of a child, since the operation, even when performed with care, is accompanied with risk to the life of the mother. Hence a cautious selection of cases should be made, as the operation is necessarily attended with some risk to both. All that we can say is that, according to general professional experience, it places the woman in a better position than she would be in if the case were left to itself. Before a practitioner resolves upon performing an operation of this kind, he should hold a consultation with others; and, before it is performed, he should feel assured that natural delivery cannot take place without greater risk to the life of the woman than the operation would itself create. These rules may not be observed by obstetric experts in large practice; but the non-observance of them is necessarily attended with some responsibility to a general practitioner. In the event of the death of the woman or child, he exposes himself to a prosecution for a criminal offence, from the imputation of which even an acquittal will not always clear him in the eyes of the public. If the child were born alive, and died merely as a result of its immaturity, this might give rise to a charge of manslaughter. Several practitioners have been tried upon charges of criminal abortion—whether justly or unjustly it is not necessary to consider; but they had obviously neglected to adopt those simple measures of prudence, the observance of which would have been at once an answer to a criminal charge. Because one obstetric practitioner of large experience may have frequently and successfully induced premature labour without observing these rules, and without any imputation on his character, this cannot shield another who may be less fortunately situated.

Chemical Evidence. Blood in Abortion. Liquor Amnii.—In the event of an abortion having taken place, stains produced by blood or by the waters (liquor amnii) may be found on the linen of a woman, and a practitioner may be required to say whether these stains are of a nature to throw any light upon the perpetration of the crime. A woman who has aborted may allege that the stains are those of the menstrual discharge. Speaking generally, there is no practical distinction between menstrual and other blood (see *ante*, p. 283). The menstrual blood contains less fibrin, is commonly acid and watery from admixture with the mucous discharges, and, when examined by the microscope, it presents epithelial scales or cells derived from the mucous membrane. These scales or cells are columnar. (See Rape, *post.*) Not much reliance can be placed upon their discovery, since the mucous membrane of the organs of respiration is lined with similar cells. Hence expectorated blood might be mistaken for menstrual. Cells of a similar shape line the whole of the mucous membrane from the stomach to the anus. The blood of piles might thus be confounded with menstrual blood. The blood discharged in abortion will present the usual characters of blood, elsewhere described (*ante*, pp. 268, 272); but it may be diluted with the waters simultaneously discharged. This question received the special attention of the French Academy in reference to the crime of abortion; and the report made was to the effect that, in the present state of science, there was no certain method by which the blood of menstruation could be practically distinguished from the blood discharged from a woman in a case of abortion or from blood in infanticide. ('Ann. d'Hyg.,' 1846, t. 1, 181.) In a more recent case, Devergie and Chevallier were required to state whether certain stains on the dress of a woman supposed to have aborted were or were not caused by the waters (liquor amnii). A chemical analysis merely revealed the presence of an albuminous liquid. The most elaborate experiments satisfied the reporters that neither by the odour nor by any other process could the liquor amnii, dried on linen, be identified. ('Ann. d'Hyg.,' 1852, t. 2, 414.) It may, however, be of importance to observe that this liquid slightly discolours and stiffens the fibre of the stuff on which it has been effused, and that it can be readily extracted by cold water. The solution contains albumen. The amount of albumen contained in the liquor amnii decreases as gestation advances. At the fourth month, it forms 10·77 per cent. of the liquid; at the fifth month, 7·67; at the sixth month, 6·67; and at the ninth month, only 0·82 per cent.

Chevallier's experiments show that the amniotic liquid has all the usual chemical properties of a very dilute solution of albumen. ('Ann. d'Hyg.,' 1856, t. 1, 156.)

INFANTICIDE.

CHAPTER 47.

NATURE OF THE CRIME.—MEDICAL EVIDENCE AT INQUESTS.—UTERINE AGE OR MATURITY OF THE CHILD.—CHARACTERS OF THE CHILD FROM THE SIXTH TO THE NINTH MONTH.—SIGNS OF MATURITY.—RULES FOR INSPECTING THE BODY.

By infanticide we are to understand, in medical jurisprudence, the murder of a *new-born* child. The English law, however, does not regard child-murder as a specific crime; it is treated like any other case of murder, and is tried by those rules of evidence which are admitted in cases of felonious homicide. In stating that 'infanticide' is the term applied to the murder of a *new-born* child, it is not thereby implied that the wilful killing should take place within any particular period after birth. Provided it be proved that the child has actually died from violence, it matters not whether it has been destroyed within a few minutes or not until several days after its birth. According to a return of the Registrar-General, it appears that out of 202 murders, 120 were perpetrated on children under one month. In the greater number of cases of infanticide, however, we find that the murder is commonly perpetrated either at the time of birth or within a few hours afterwards. Although the law of England treats a case of infanticide as one of ordinary murder, yet there is a difference in the nature of the medical evidence required to establish the murder of a new-born child. It is well known that many children come into the world dead, and that others die from various causes soon after birth; and in the latter, the signs of their having lived are frequently indistinct. Hence, to provide against the danger of erroneous accusations, the law humanely assumes that every new-born child has been born dead, until the contrary appears from the medical or other evidence. The onus of proof that a *living* child has been destroyed is thereby thrown on the prosecution; and no evidence imputing murder can be received unless it be first made certain, by medical or other facts, that the child survived its birth, and was *legally* a *living* child when the alleged violence was offered to it. Hence there is a most difficult duty cast upon a medical witness on these occasions. In the greater number of cases the woman is delivered in secrecy, and no one is present to give evidence respecting the birth of the child. It is under these circumstances that medical evidence is especially required. For reasons elsewhere assigned, a medical man should be cautious in putting questions to a woman charged with this crime.

In most instances, however, the body of the child is found, an inquest is held, and medical evidence is demanded. In giving evidence at a coroner's inquest in a case of child-murder, as much care should be taken by a practitioner as if he were delivering it before a judge of assize. Some medical witnesses are disposed to treat an inquest with indifference, and to be careless in their evidence, thinking probably that, should the case come to a trial, they could easily prepare themselves, and amend any statements which had been hastily made before a coroner's jury. But it should be remembered that the depositions taken by this officer are placed at the trial in the hands of the judge, as well as of the prisoner's counsel; and, should a witness deviate in his evidence from that which he gave at the inquest, or should he attempt to amend or explain any of the statements then made, so that they might be represented as having a new bearing on the prisoner's case, he would expose himself, not merely to a severe cross-examination, but probably to the censure of the court. If medical men were to reflect that, in delivering their opinions before a coroner and jury, they are, in many instances, virtually delivering them before a superior court, it is certain that many unfortunate exposures would be easily avoided.

Uterine Age or Maturity of the Child. Viability.—One of the first questions which a witness has to consider in a case of alleged child-murder is that which relates to the age or probable degree of maturity which the deceased child may have attained *in utero*. The reason for making this inquiry is that the chances of natural death in all new-born children are great in proportion to their immaturity; and that, supposing them to have survived birth, the signs of their having breathed are commonly obscure. It is found that the greater number of children who are the subjects of these investigations have reached the eighth or ninth month of gestation; yet charges of murder might be extended to the wilful destruction of children at the seventh month or under, provided the evidence of life after birth was clear and satisfactory.

The following are the characters whereby we may judge of the uterine age of a child from the *sixth* to the *ninth* month of gestation, a period which may be considered to comprise cases of abortion as well as child-murder:—

1. Between the *sixth* and *seventh* months.—The child measures, from the vertex to the sole of the foot, from ten to twelve inches, and weighs from one to three pounds. The head is large in proportion to the trunk; the eyelids are adherent, and the pupils are closed by membranes (membranæ pupillares). The skin is of a reddish colour, and the nails are slightly formed; the hair loses the silvery lustre which it previously possessed, and becomes darker. Ossification proceeds rapidly in the chest-bone, and in the bones of the foot; the brain continues smooth on its surface; there is no appearance of con-

volutions. In the male the testicles will be found in the abdominal cavity, lying upon the psoæ muscles, immediately below the kidneys. In March, 1885, a primiparous married woman was delivered in Guy's hospital, after severe puerpural convulsions. The fœtus (male) was dead, but the fœtal heart had been heard by Horrocks a week before. The fœtus was fifteen inches and a half long, and weighed two pounds only. There were points of ossification in the upper portion of the sternum; none in the astragalus, nor in the lower sacral vertebræ. Hence the uterine age of the child was judged to be six months. Nevertheless, both testicles were found in the scrotum.

2. Between the *seventh* and *eighth* months.—The child measures between thirteen and fourteen inches in length, and weighs from three to four pounds. The skin is thick, of a more decidedly fibrous structure, and covered with a white unctuous matter which now appears for the first time. Fat is deposited in the cellular tissue, whereby the body becomes round and plump; the skin previously to this is of a reddish colour, and commonly more or less shrivelled; the nails, which are somewhat firm, do not quite reach to the extremities of the fingers; the hair is long, thick, and coloured; ossification advances throughout the skeleton; valvulæ conniventes appear in the small intestines, and meconium is found occupying the cæcum and colon. The testicles in the male about this period commence their descent towards the scrotum. The time at which these organs change their situation is probably subject to variation. According to Hunter, the testicles are situated in the abdomen at the seventh, and in the scrotum at the ninth month. Burns believes that at the eighth month they will commonly be found in the inguinal canals. The observation of the position of these organs in a new-born male child is of considerable importance in relation to maturity, and it may have an influence on questions of legitimacy as well as of child-murder. Curling thus describes their change of position: At different periods between the fifth and sixth months of fœtal existence, or sometimes even later, the testicle begins to move from its situation near the kidney towards the abdominal ring, which it usually reaches about the *seventh* month. During the eighth month it generally traverses the inguinal canal, and by the end of the ninth, arrives at the bottom of the scrotum, in which situation it is commonly found at birth. ('Dis. of the Testis,' 2nd edit., p. 17.) Its absence from the scrotum does not necessarily indicate that the child is immature, because the organ sometimes does not reach the scrotum until after birth.

3. Between the *eighth* and *ninth* months.—The child is from fifteen to sixteen inches in length, and weighs from four to five pounds. The eyelids are no longer adherent, and the membranæ pupillares have disappeared. The quantity of fat deposited beneath the skin is increased, and the hair and nails are well developed. The surface of the brain is grooved or fissured, but presents no regular convolutions: and the grey matter is not yet apparent. The meconium occupies almost entirely the large intestines; and the gall-bladder contains some traces of a liquid resembling bile. The testicles in the male may be found

occupying some part of the inguinal canal, or they may be in the scrotum. The left testicle is sometimes in the scrotum, while the right is situated about the external ring.

4. *Ninth Month. Signs of Maturity.*—At the ninth month the average length of the body is about eighteen inches, and its weight from six to seven pounds; the male child is generally rather longer, and weighs rather more, than the female. Extraordinary deviations in length and weight are occasionally met with. Owens has recorded a case in which a child at delivery measured twenty-four inches in length, and weighed seventeen pounds twelve ounces ('Lancet.,' Dec. 1838), and Meadows has reported another in which a child measured, after death, thirty-two inches, and weighed eighteen pounds two ounces. It survived four hours. ('Med. Times and Gaz.,' 1860, ii. p. 105.) In one case which the author examined, the child, a male, measured twenty-two inches, and weighed twelve pounds and a half. Davies had a case in which a child was born alive, weighing nineteen pounds two ounces, probably the heaviest new-born child on record. ('Med. Times and Gaz.,' 1860, i. p. 249.) (For some practical remarks on this subject, by Ellsässer, see Henke's 'Zeitschrift,' 1841, vol. 2, p. 235.) According to Duncan, the length and weight of a child vary according to the age of the mother. They are greatest among children when the mother is from 25 to 29 years of age; but the facts collected do not support this statement; for the child of a woman at 22 weighed seven pounds three ounces, and that of a woman of 30, seven pounds seven ounces. The length varied in a less degree, being for the different ages at or about nineteen inches. ('Edin. Month. Jour.,' 1864, ii. p. 500.)

At the full period, the head of a child is large, and forms nearly one-fourth of the whole length of the body. The cellular tissue is filled with fat, so as to give considerable plumpness to the whole form, while the limbs are firm, hard, and rounded; the skin is pale; the hair is thick, long, and somewhat abundant; the nails are fully developed, and reach to the end of the fingers—an appearance, however, which may be sometimes simulated in a premature child, by the shrinking of the skin after death. The testicles in the male are generally within the scrotum. Ossification will be found to have advanced considerably throughout the skeleton. The surface of the brain presents convolutions, and the grey matter begins to show itself. The internal organs, principally those of the chest, undergo marked changes, if the act of respiration has been performed by the child before, during, or after its birth. The external auricle now measures an inch and a quarter to an inch and a half in length, seven-eighths of an inch to one inch in width, and varies little in children of very varied sizes. Medical jurists place great stress on the presence of a point of ossification in the lower epiphysis of the thigh-bone (femur) in its bearings upon the maturity of the fœtus. This point usually first makes its appearance at the 36–37th week; at the 37–38th week it is commonly the size of the head of a house-fly; and at the full period it is of one-fourth to one-third of an inch in diameter. When this point of ossification is one-third of an inch in diameter, it may be confidently affirmed that the fœtus has reached the full period; but where the point is only one-fourth of an inch in diameter, it cannot be positively asserted that the child is mature, though it is probable that such is the case.

The characters which have been here described as belonging to a child at the different stages of gestation must be regarded as representing an average statement. They are open to numerous exceptions; for some children at the ninth month are but little more developed than others at the seventh. Twins are generally smaller and less developed than single children: the average weight of a twin child is not more than five pounds, and very often below this. The safest rule to follow in endeavouring to determine the uterine age of a child is to rely upon a majority of the characters which it presents. That child only can be regarded as *mature* which presents the greater number of the characters described, as met with in children at or about the ninth month of gestation.

If the age of the child has been determined, whether it be under or over the seventh month, the rules for a further investigation will be the same. Should the child be under the seventh month, the medical presumption will be that it was born dead; but if it has arrived at the full period, then the presumption is that it was born alive.

Conclusions.—The following may be taken as a summary of the principal facts upon which our opinion respecting the uterine age of a child may be based:—

1. At *six months.*—Length, from nine to ten inches; weight, one to two pounds; eyelids agglutinated; pupils closed by membranæ pupillares; testicles not apparent in the male.
2. At *seven months.*—Length, from thirteen to fourteen inches; weight, three to four pounds; eyelids not adherent; membranæ pupillares disappearing; nails imperfectly developed; testicles not apparent in the male.
3. At *eight months.*—Length, from fourteen to sixteen inches; weight, from four to five pounds; membranæ pupillares absent; nails perfectly developed, and reaching to the ends of the fingers; testicles in the inguinal canal.
4. At *nine months.*—Length, from sixteen to twenty-one inches; weight, from five to nine pounds; membranæ pupillares absent; head well covered with fine hair; testicles in the scrotum; skin pale; the finger-nails well formed and reaching to the ends of the fingers; the features perfect—these and the body are *well developed* even when the length and weight of the child are less than those above assigned.
5. The external auricle measures an inch and a quarter to an inch and a half in length, and seven-eighths of an inch to an inch in breadth.

Inspection of the Body.—The questions which a medical jurist has to solve, in examining the body of a new-born child, are: 1. To determine its age, or the stage of uterine life which it has reached. 2. Whether it has lived to breathe. 3. Whether it has been born alive. 4. The period of time which has elapsed since its death. 5. The cause of death, whether violent or natural.

Hence, before commencing the inspection, note—

1. The length (measured from the summit of the head to the sole of the foot) and weight of the body. 2. The presence or absence of external fœtal peculiarities. 3. Any peculiar marks or indications of deformity whereby identity may be sometimes established. 4. All marks of violence, in the shape of wounds, bruises, or lacerations, and the kind of instrument or weapon by which they were probably produced. 5. Whether the navel-string has been cut and tied, or lacerated: the appearance of the divided vessels, and the length of that portion which is still attached to the body of the child. 6. The presence or absence of vernix caseosa about the groins, armpits, or neck—the presence of this substance proving that a child has not been washed or attended to. 7. It will be necessary to state whether there are about the body any marks of putrefaction, indicated by a separation of the cuticle, change of colour in the skin, or offensive odour. It is obvious that, unless the circumstances are noticed before the inspection is commenced, they may be entirely lost as evidence. Notes should be made on the spot, and the original retained, even if copies be subsequently made.

A medical man cannot be too careful in noticing upon the body of the child any special characters which may serve as proofs of identity. He must remember that the defence may be that the child is not that of the woman charged with murder. This observation applies especially to the examination of the bodies of children that may have survived their birth for some days. The body may be found wrapped in paper or in some article of clothing which may help to establish identity. If the child has survived its birth, it would be well to form an opinion as to how many days it has lived. The state of the navel-string, or, if separated, whether the part of the abdomen to which it was attached is in the process of healing or already healed,—are facts which may help a medical opinion respecting the date of birth. In addition to these points, the sex of the child and the colour of the hair should be noted, as well as any particular marks on the skin, nævi (mother's marks) or moles, and, of course, all wounds or other injuries—their probable cause or mode of production, and their situation.

CHAPTER 48.

EVIDENCE OF LIFE BEFORE RESPIRATION.—PUTREFACTION IN UTERO.—EVIDENCE OF LIFE AFTER RESPIRATION.—COLOUR, VOLUME, CONSISTENCY. PRESENCE OF DEVELOPED AIR-CELLS, AND ABSOLUTE WEIGHT OF THE LUNGS. —STATIC TEST.—WEIGHT INCREASED BY RESPIRATION.

THE question whether a child was or was not *born alive* is of great importance in a case of alleged child-murder; and it is unfortunately one which, in respect to the proofs upon which medical evidence is commonly founded, has given rise to considerable controversy. When it is stated that in most cases of alleged infanticide which end in acquittals in spite of the strongest moral presumptions of guilt, the proof fails on this point only, it must be obvious that this question especially claims the attention of a medical jurist. The medical evidence of a child having been alive, when violence was offered to it at its birth or afterwards, may be divided into two parts: first, that which is obtainable before the act of respiration is performed; and second, that which is obtainable afterwards. At present we shall confine our attention to the question whether the child was legally *living* when it was maltreated,—the fact of its having been *born* alive will be a matter for future consideration. These two questions have been frequently but improperly associated, thus rendering the subject confused; but it must be so obvious as scarcely to require stating, that violence of a murderous kind may be offered to a living child *before* it is entirely born; and that owing to this violence it may come into the world dead.

Proofs of Life before Respiration.—It was formerly supposed, if the lungs contained no air, that the child could not have breathed, and must have been born dead; but this is now known to be an error. Children are able to breathe feebly, and continue in existence many hours without visibly distending the cells of the lungs with air; the absence of air from the lungs, therefore, furnishes no proof either that respiration has not been performed, or that the child has not lived after birth. The restoration of many children apparently born dead is in itself a clear proof that many are born living who might be pronounced dead, simply because 'breathing' and 'life' have been erroneously considered as synonymous terms. That our law authorities will admit evidence of life in a child before the establishment of respiration is clear from the decision in *Rex* v. *Brain*, in which the judge said that a child might be born *alive*, and not breathe for some time after its birth (Archbold, 'Crim. Plead.,' 367); as also from the charge of Coltman, J., in the case of *Rex* v. *Sellis* (Norfolk Spr. Circ., 1837). In this instance it was alleged that the prisoner had murdered her child by cutting off its head. The judge directed the jury, that if the child was *alive* at the time of the act, it was not necessary, in order to constitute murder, that it should have breathed. In fact, it would appear that respiration is regarded as only *one* proof of life; and the law will, therefore, receive any other kind of evidence which may satisfactorily show that a child has lived, and make up for the proof commonly derived from the state of the lungs.

In these cases it will be first necessary for a medical practitioner to prove that the child under examination has recently died, or, in other words, that there are good grounds for believing it to have been *recently living*. Hence, if the body is highly putrefied, either from the child having died in the womb some time before birth, or from its having been born and its body not discovered until putrefaction had far advanced both internally and externally, the case is beyond the reach of evidence. A medical witness will in general be compelled to abandon the investigation, because the body can furnish no evidence whatever of life after birth. The examination of the thoracic organs would throw no light on the case, for here we are assuming that the lungs are in an unexpanded condition.

Evidence from Marks of Violence on the Body.—It has been proposed to seek for evidence of life, under these circumstances, by observing the characters presented by marks of violence on the body. In general, when children are murdered, the amount of violence inflicted is considerably greater than that which is required to destroy them, whereby satisfactory proofs of the crime are occasionally obtained. On the other hand, the body of a still-born child, dead from natural causes, is often covered with lividities and ecchymoses; and as the blood of the fœtus or child does not coagulate with the same firmness as that of the adult, the evidence derivable from the extent, situation, and characters of marks of violence is often of too vague and uncertain a kind to allow of the expression of a medical opinion that the child was living when the violence was offered to it. The characters which have been already described as peculiar to wounds and contusions inflicted during life (pp. 234, 237) may be met with in the body, whether the child has breathed or died without breathing. So, again, these characters are open to the exceptions there pointed out; for they will be equally present, supposing the wounds to have been inflicted immediately after the cessation of respiration or circulation in the child, or after the cessation of circulation only,—if the act of respiration has not been performed. But marks of violence on the body of a child that had died *in utero* twenty-four or forty-eight hours before it was born, would not present the characters of injuries inflicted on a living child. There would be no ecchymosis and no effused coagula of blood. These marks, when they exist, although they may establish that a child was either living or but recently dead at the time they were inflicted, cannot show that it was *born* alive. Injuries met with on the bodies of children alleged to have been born dead ought, however, to be of such a nature as to be readily explicable on the supposition of their having arisen from accident. If, from their nature, extent, or situation, they are such as to evince a wilful or intentional design to injure, it is a fair ground for a jury, not for a medical witness, to inquire why these extensive wounds, or other marks of violence, were inflicted on a child, if, as it is alleged, it was really born dead. It must be confessed that in such a case there would be a strong moral presumption of murder, although medical proof of life or of actually live birth, might totally fail.

As a summary of these remarks, it may be observed that, although physiologically a child may live for a certain period after its birth without breathing—and legally its destruction during this period would amount to murder—yet there are at present no satisfactory medical data to enable a witness to express a positive opinion on this point in the majority of cases. If other evidence were adduced of a child having lived and been destroyed under these circumstances—as where, for example, a woman causes herself to be delivered in a bath of water, or an accomplice covers the mouth of an infant in the act of birth, or immediately after it is born—a medical witness would be justified in asserting that the absence of the signs of respiration in the lungs was no proof that the child had been born dead. Indeed, it is apparent that breathing could not be established, owing to the criminal means actually employed to prevent it. The absence of air from the lungs may, therefore, really be the result of the forcible *prevention of respiration* during the act of birth. There cannot be any doubt that living children are occasionally thus destroyed: they die, not from the actual infliction of violence, but because, either through design or accident, the performance of that act which is necessary to maintain existence when the child is born is prevented. Whether a jury would convict under these circumstances is doubtful; but this is of no importance to the witness, for his statements ought always to be made according to correct and well-ascertained medical principles, and not for the purpose of procuring either the conviction or acquittal of persons accused of crime. In general, those cases in which questions relative to life before respiration might arise, are stopped in the coroner's court, the usual practice being, when the signs of respiration are absent or imperfect, to pronounce that the child was born *dead*. If the lungs sank in water, the presence of marks of violence on the body would be considered as furnishing no evidence; for the sinking of the lungs would in general be taken as a proof that the child was born dead, and that there could have been no murder.

This subject has been fully considered by Caussé. ('Des Preuves de la Vie en Matière d'Infanticide:' 'Ann. d'Hyg.,' 1878, t. 2, p. 471.) After denouncing it as a great error to assert and act upon the principle that life and respiration are synonymous (*Vivre, c'est respirer*), he quotes many instances in which children have been born living, and survive birth for some time without breathing. It is during this period that an act of murder may be perpetrated, and satisfactory proofs of the crime may be frequently obtained by an examination of the body, irrespective of the condition of the lungs. In such children the heart continues to pulsate, and the circulation is carried on by the foramen ovale and the ductus arteriosus, as in the fœtal state. The proof of this is seen in the fact that these children may be roused and made to breathe many minutes and even a quarter of an hour after birth. Caussé contends that if any ecchymosis is found on the skin of a new-born child, this is a proof that the blood was at the time circulating in the body of the child, and that it had been extravasated, as it would be from violence applied to the living body. Such extravasations indicate the movement of blood towards the parts affected, and thereby furnish a proof of the existence of life at the time when the violence was inflicted. This proof would be strengthened in cases in which the blood was found coagulated, and the cellular membrane or fractured bones largely infiltrated. These are the essential characters of injuries inflicted on a living body, and they carry with them proofs of life from circulation as strongly as the presence of air in the lungs indicates life from respiration. The same remarks may be made respecting burns, attended with blisters containing serum or a line of redness (see p. 378). Assuming the child to have been born dead, these acts of violence could not have produced similar appearances on the body.

Caussé is supported by Devergie in considering respiration as only one sign of life, and that it may be absent in a child living for a quarter of an hour or longer after birth. The fœtal circulation of the blood is equally a sign of life after birth, indicated by the marks of contusions, ecchymoses, and coagulation of the blood. In a case which occurred to Devergie, there were severe contusions with ecchymosis about the head of the child; the temporal muscles were deeply ecchymosed, and blood was infiltrated in the muscular fibres. The lungs, entire and divided, sank in water. They contained no air, and there was no evidence of breathing. The conclusions drawn by him were that this child had lived and had been destroyed by violence to the head. The injuries were the result of violence applied during life, and could not have been produced on the body of the child while in the womb. (‘Ann. d'Hyg.,’ 1837, t. 1, p. 407.)

In order to justify any inference respecting the life of a new-born child under these circumstances, the wounds or injuries should have those well-marked characters which have been elsewhere assigned to wounds on the living body (p. 234), and they should be of such a nature that they could not have been produced on the child by any accident when in the womb.

There is a class of cases in which a child is born alive, but its lungs remain in the fœtal condition, *i.e.* they present no appearance of having received air by the act of breathing. These are cases of atelectasis (p. 573). The appearances in the body are the same as in still-born children. Donders, who met with one of these cases in which he, in ignorance of the facts, pronounced a child to be still-born when it was distinctly proved that it had lived twelve hours, says, ‘Where the signs of an extra-uterine life, which does not betray itself by air in the lungs, are to be found, futurity must declare.’

Proofs of Life after Respiration.—There is no doubt that the proof of the act of respiration furnishes the best and strongest evidence of a child having lived at or about the time it was born. It does not, however, show that a child has been *born alive.* The physical changes in the body of a child, which result from the establishment of this process, take place in the lungs immediately, and in the heart and its appendages more slowly. It is, therefore, chiefly to the *lungs* that a medical witness looks for proofs of respiration. Sometimes, however, these organs are found in their fœtal condition, or nearly so; for, although a child may have survived its birth many hours, there may be no evidence of the fact from the state of the lungs. To such cases the remarks now about to be made cannot, of course, apply: the proofs of life must then be sought for elsewhere, and, if none can be found, the case is beyond the reach of medical evidence. But it is obvious that the occasional occurrence of cases of this description can present no objection to our still seeking for proofs of life in the state of the lungs, any more than the fact of poison not being always discovered in the body of one who has died from poisoning would be a bar to our seeking for the proofs of poison in any unknown case which presented itself. It is the more necessary to insist upon this point, because some have held that, as we cannot always derive proofs of life from an examination of the lungs of new-born children, we should abandon all evidence of this description and leave the case in its original obscurity. The very object of medical jurisprudence is to endeavour to remove these difficulties, and to show in every department of the science the degree to which we may safely trust the medical proofs of crime, however insufficient, inconsistent, or contradictory they may at first sight appear.

Examination of the Lungs.—The cavity of the chest may be conveniently laid open by carrying incisions from below the clavicles downwards on each side from about half the length of the ribs backwards. The diaphragm should be separated from the cartilages without opening the abdomen; the ribs sawn or cut through, and the flap formed by the front of the chest turned upwards,—though some prefer to turn the flap downwards. The differences in the relative positions of the organs of the chest before and after respiration may be thus stated: 1. If a child has *not breathed*, the thymus gland, as large as the heart, will be found occupying the upper and middle portions of the chest; the heart, within its membrane (pericardium), is situated in the lower and middle portion, and is rather inclined to the left side. The lungs are placed quite in the back part of the chest, so as often to give the impression that they are wanting. In some instances they project slightly forwards by their anterior margins, but in no instance, unless congested, infiltrated, or otherwise diseased, do they cover and conceal the heart. The thymus gland is sometimes of a pale fawn—at others of a deep livid colour; but there is no perceptible difference in this organ in new-born children, before or after the performance of respiration. 2. On the other hand, when a child has *fully breathed*, the most striking differences will be observed in the colour and prominence of the lungs. They are of a light-red hue, project forwards—appear to fill the entire cavity of the chest, and cover and in great part conceal, by their anterior margins, the heart and its membrane. We may meet with every variety in the appearances between these two extremes; for the process of respiration often requires a considerable time in order that it should be *fully* established, especially in children which are of a weakly constitution or prematurely born. Hence the lungs will be found to occupy their respective cavities to a greater or less extent, and to cover the pericardium more or less, not according to the length of time which a child has lived, but according to the perfection with which respiration has been performed. Although, as a general rule, the lungs are more perfectly filled with air in proportion to the time during which a child survives its birth, yet this is open to numerous exceptions. The physical characters of the lungs now require notice.

Colour.—The colour of the lungs *before respiration* is bluish-red or deep violet, but it is subject to variation. Some medical jurists have compared it to the colour of the spleen. A short exposure to air will materially brighten the colour in the parts exposed, so that it should be observed and recorded immediately on opening the chest. *After respiration*, the lungs acquire a light-red hue in proportion to the degree in which the process has been performed. If imperfectly established, they will be mottled or marbled, generally about the anterior surfaces and margins, the patches of light red being intermixed with the livid fœtal hue, and being slightly raised, as if by distension, above the general surface of the organs. The light-red tint changes, after a short exposure to air, to a bright scarlet.

Volume.—Before respiration, the lungs are in general scarcely visible, unless forcibly drawn forwards in the chest. When it has been perfectly accomplished, the volume is so much increased that the bag of the heart (pericardium) is almost concealed by them. Respiration must, however, have been perfectly performed in order that this condition should exist to the full extent described.

Consistency.—The lungs, *before respiration*, feel like the liver, or any other of the soft organs of the body. They are firm under the finger, but their substance may be lacerated by violent compression. *After respiration* has been fully performed, there is a distinct sensation of what is termed crepitation, on compressing them, *i.e.* air is felt within them. If a thin section of the lung be submitted to examination with a low power of the microscope—*before respiration* it will present a solid appearance—after respiration, air-cells will be distinctly seen in it. These conditions of the lungs must, of course, depend on the degree to which respiration has been carried. The lungs of children that have lived for a considerable time after birth will sometimes give no feeling of crepitation under the finger. Generally speaking, lungs of this kind present the other fœtal characters; thus they are small and of a livid colour, and no air-cells may be detected on a microscopical examination.

Development of Air-Cells.—On the right lung, and especially on the edges and concave surface of its upper lobe, the first appearances of respiration may be visible, even when the rest of the lungs retain their fœtal condition. Here it is that the highly characteristic developed air-cells are first visible. These, if the lungs are fresh and full of blood, take the form of bright vermilion spots; but if the lungs contain less blood, or are examined some days after death, the spots are of a lighter tint. (Guy's and Ferrier's 'For. Med.,' 5th edit., p. 104.) The form and arrangement of these cells are also characteristic—they are angular, and are not perceptibly raised above the surface of the lung. They may be either irregularly grouped or arranged in sets of four, and their outline is distinctly polygonal. They are best seen with the naked eye, or at most with a lens of low power. Their form, their immobility when the finger is passed over the surface of the lung, their colour, and the fact that they are not raised above the surface of the lung, render a mistake of these cells for the minute bullæ of putrefaction, melanotic spots, or minute ecchymoses, impossible, if ordinary care be exercised. The same development of air-cells may be brought about by artificial respiration. Nevertheless, these air-cells are of great value as proving either respiration or artificial respiration.

Absolute Weight of the Lungs. The Static Test.—The absolute weight of the lungs before respiration is less than that which they have after the establishment of the process. From this an inference has been drawn that the absolute weight of the lungs in an unknown case, compared with certain averages, will aid the inquirer in ascertaining whether respiration has or has not been performed. In order to determine the weight of the lungs, these organs should be carefully separated by dissection from the heart and thymus gland, and removed with the windpipe and bronchi attached. Previously to their removal, ligatures should be placed on the pulmonary vessels, so that no blood may escape from the lungs. They should now be weighed, and the weight accurately noted in grains. The average weight *before respiration,* derived from nine cases, was found to be 649 grains. According to Traill, the weight varies from 430 to 600 grains. It is of importance, in taking the weight of these organs, to observe whether the child is at or near maturity, and whether its body is fully developed, or of about *the average size and weight:* owing to a neglect of this rule, it is highly probable that comparisons have been made of the absolute weight of the lungs in children of different ages, which a full statement of the facts would not have justified. If it is small and immature, or unusually large, the lungs will weigh either less or more than the average. The average weight of the lungs, *after respiration,* derived from three cases, was 927 grains; but in making an estimate of this kind, much will depend upon the degree to which respiration has been carried. In three cases, in which the children lived half an hour, six hours, and twenty-four hours respectively, the process had been so imperfectly performed that the lungs varied but little in weight from the average before respiration. ('Guy's Hosp. Rep.,' 1837, ii. p. 318.) The truth is, we cannot compare the lungs of children, as to weight, by the *time* which they may have survived birth, but rather by the *degree* to which the lungs have been penetrated by air. Another circumstance must also be considered in basing an opinion on the absolute weight of the lungs. Although there does not appear to be any strict normal relation between the weights of the body and lungs in new-born children, yet it is certain that, in the bodies of children of unusual weight, the lungs will be found much heavier than the average, whether the child has breathed or not. The body may vary from six to eighteen pounds; and the lungs under these circumstances will also differ in weight.

The healthy lungs of mature new-born children become heavier after respiration, and according to its degree; and where a deviation from this rule is observed, it may probably be explained by the circumstance that the lungs of an immature have been compared with those of a mature child—the lungs of an undeveloped twin with those of one not a twin, or the lungs of one which has breathed imperfectly with those of another in which respiration has become well established.

It is very well known to, and admitted by, all medical jurists, that there are some instances in which the fact of respiration cannot be determined by the application of the static or any other test to the lungs, simply because they contain no air. Increased weight, therefore, is only one among several circumstances to which a medical jurist should attend.

Great weight of the lungs can obviously furnish no proof of respiration, unless this is accompanied by the other physical changes indicative of the process; as, for example, increase in volume from the presence of air, crepitation, and the detection of air-cells. If the lungs are heavy, and at the same time contain little or no air, the increase of weight must depend upon disease or other abnormal causes, not upon respiration. In one case, the lungs were large, and weighed upwards of 1200 grains. They contained no air; when divided into thirty pieces, not one portion floated, nor could any air be seen on the closest examination. It was therefore clearly impossible to ascribe a weight so much above the average to the effects of respiration. On the other hand, in another case, the lungs of a new-born child apparently full-grown, although fully distended with air, weighed only 626 grains. In this case the body of the child weighed only six pounds, and a quantity of blood had, no doubt, escaped from the lungs, owing to the pulmonary vessels not having been tied before their removal from the chest. It must not be forgotten that all the physical characters presented by lungs that have respired are liable to certain fallacies; but these may be removed, or the force of the objection diminished, by not basing an opinion on one or two conditions only. We should take the whole combined; for it would be as wrong to regard great weight in the lungs *taken alone* as an absolute proof of respiration, as it would be to draw the same inference from a mere change in the colour, volume, or consistency of the organs.

Ploucquet proposed to determine whether the act of respiration had taken place or not by a comparison of the absolute weight of the lungs with the weight of the body of a child. This, which has been called the *test of Ploucquet,* is based on the fallacy that there is an invariable relation between the weights of the lungs and bodies in new-born children. No such relation exists, and this method of arriving at a solution of the question of respiration has been abandoned by all medical jurists.

The Specific Gravity of the Lungs.—The specific gravity of the lungs is greater before than after respiration; for although the organs become absolutely heavier by the establishment of the process, this is owing, not to the air, but to the additional quantity of blood received into them. The air thus received so increases the volume of the lungs as to more than counteract the additional weight derived from the blood, and thus apparently to diminish their specific gravity. Under these circumstances they readily float on water. The specific gravity of the lungs before respiration, *i.e.* in the fœtal condition, varies from 1·04 to 1·05. They are about one-twentieth part heavier than their bulk of water. After respiration, the specific gravity of the lungs, with the air contained in them, is 0·94; *i.e.* the organs are about one-seventeenth part lighter than their bulk of water. The introduction of a very small quantity of air will render the lungs buoyant in water, and an alteration in their volume, sufficient for this purpose, would not be perceptible to the eye. It will be understood that the specific gravity of the substance of the lungs is unchanged; the organs are rendered only apparently lighter by the air contained in their cells, on the same principle as a bladder filled with air. Hence it follows that the apparent diminution of specific gravity will take place, whether the air is derived from respiration, artificial inflation, or putrefaction. It is on this property of the lungs that the application of what is termed the *hydrostatic test,* or the *docimasia pulmonaris,* is founded—a subject which may be appropriately considered in another chapter.

Conclusions.—The general conclusions which may be drawn from the contents of this chapter are—

1. That a child may be born alive, and be criminally destroyed before it has breathed.
2. That the presence of any marks indicative of putrefaction while the child was in the womb proves that it must have come into the world dead.
3. That there are no certain medical signs by which a child that has not breathed can be proved to have been living when it was maltreated.
4. That a new-born child may be destroyed by the prevention of respiration during delivery.
5. That by taking together the colour, volume, consistency, absolute weight, and buoyancy of the lungs, and the presence in them of developed air-cells, we may be able to draw an inference whether the child has or has not breathed.
6. That the lungs increase in weight according to the degree to which respiration is established, and not necessarily according to the period which the child has survived birth.
7. That no reliance can be placed upon the test of Ploucquet, or the proportionate weight of the lungs to the body.

CHAPTER 49.

THE HYDROSTATIC TEST.—SINKING OF THE LUNGS FROM DISEASE OR ATELECTASIS.—LIFE WITH PERFECT ATELECTASIS OR ENTIRE ABSENCE OF AIR FROM THE LUNGS.—ERRONEOUS MEDICAL INFERENCE FROM SINKING OF THE LUNGS.—FLOATING OF THE LUNGS FROM PUTREFACTION.—EFFECTS OF PUTREFACTION ON THE LUNGS.

The Hydrostatic Test.—The mode of employing this test is extremely simple. Having removed the lungs from the chest, they should be placed, still connected with the air-tubes, upon the surface of distilled or river water. If they sink, it should be noted whether the sinking takes place rapidly or slowly. If they both sink, the two lungs should be tried separately; for it is sometimes found that one, commonly the right, will float, while the other will sink. Supposing that both lungs sink, they should be divided each into twelve or fifteen pieces, and these pieces placed separately on water. If after this they all sink, the inference is that, although the child may have lived and survived its birth, *there is no evidence of its having breathed.* On the other hand, the organs when placed on water may float: it should then be noticed whether they float high above the surface, or at or below the level of the water; sometimes they indifferently float or sink. These differences will lead to a conclusion respecting the degree to which respiration has taken place. It will now be proper to separate the lungs, and determine whether the buoyancy is due to one or both. Each lung should be divided as before, and each piece separately tried. If all the pieces float, even after firm compression, we have good evidence, *cæteris paribus*, that respiration has been very perfectly performed. Should any of the divided portions sink in water, either before or after compression, our opinion should be modified accordingly. Some have recommended that the lungs should be placed on water with the heart and thymus gland attached; but there appears to be no good reason for this, since it is as easy to form an opinion of the degree of buoyancy possessed by the lungs, from the readiness with which they float, as by observing whether or not they have the power to support these two organs.

With regard to the inference derivable from the use of this test, it should be observed that the floating of the lungs in water is not, as it is often incorrectly represented to be, a proof that a child has been *born alive;* nor is the fact of their sinking in water any proof that a child was *born dead.* The floating, under the limitations to be described, proves only that a child has *breathed*, the sinking, either that it has *not breathed* or breathed but imperfectly. The fact of a child having been *born* living or dead has, strictly speaking, no relation to the employment of the hydrostatic test. There are cases of infanticide which may be readily established without resorting to this test, and others which cannot be proved by its use; all that the law requires is proof that a child has been born living, and whether this proof be furnished by the state of the lungs through the hydrostatic test, or in any other manner, is of no moment. The signs of life are commonly sought for in the lungs, because it is in these organs that the changes produced by a new state of existence are most distinctly perceived; but this examination may be dispensed with when the woman confesses that the child was born alive, when others have seen it manifest life by motion or otherwise after its birth, or, lastly, in cases where, without being seen, it has been heard to cry. The crying of a child has been admitted as evidence of live birth on several trials for infanticide; although, as it is elsewhere stated, a child may utter a cry and die before its body is entirely born. Among the *objections* which have been urged to the employment of the hydrostatic test, we have first to consider those which concern the sinking of the lungs in water.

Sinking of the Lungs from Disease, or Atelectasis.—It is said that the hydrostatic test cannot show whether a child has or has not survived its birth, because the lungs of children that have lived for a considerable period have been observed to sink entirely in water. In some instances this may depend on disease, tending to consolidate the air-cells, as *hepatization* or *scirrhus*; in others, on *œdema* or *congestion*; but these cases can create no difficulty, since the cause of the lungs sinking in water would be at once obvious on examination. The hepatized portion of lung may be known by the firmness with which it resists cutting with a knife, as also by the fact that it is impossible to distend it artificially with air. On the other hand, there are cases in which the lungs appear healthy and unaffected—all that we can perceive is that they retain their fœtal condition. This is a very different state from that of hepatization, because the lungs, in this unexpanded condition, may be made to receive air by artificial inflation. It is remarkable that life should continue for many hours, and sometimes even for days, under such a condition; but the occasional existence of this state of the lungs in a living child is placed beyond all dispute; the explanation of the causes upon which it depends—how it is that a child may live for hours or days, and no signs of respiration be discovered in its body after death—is, however, involved in difficulty. The lungs appear to be simply unexpanded, or to retain their fœtal condition; a state to which the name of *atelectasis* has been given. This condition may be found to affect the whole or a part of the organs. Albert met with a case in which a child died *thirty-six hours* after its birth, having been attacked by convulsions at intervals during that time. On inspection, the whole of the right, and the lower portion of the left lung, were found to be in their fœtal condition, and they immediately sank when immersed in water. There was no diseased appearance in the organs, and the undistended portions were easily filled by blowing air into them. (Henke's 'Zeitschrift,' 1837, vol. 2, p. 422.) Dépaul found in many cases in which children had died suddenly after breathing for several hours or days, that the only unusual appearance in the body was an unexpanded condition of a large portion of the lungs. ('Lond. Med. Gaz.,' vol. xxxix. p. 283.)

It is necessary for a medical jurist to be aware that the state of the lungs which is here called *atelectasis* is by no means unfrequent among new-born children. When no portion of air is found in the lungs of a child, there is no test by which such a case can be distinguished from one in which the child has come into the world dead. These cases of atelectasis are ordinarily set down as exceptions to a general rule; but they are more common than some medical jurists are inclined to admit. In examining the body of a child the history of which is unknown, it is proper that the possible occurrence of such cases should be well borne in mind. It appears not improbable that many such come yearly before coroners in this country, and that they are dismissed as cases of still-born children, notwithstanding that marks of violence are often found upon the bodies. If, as it has been already observed, the lungs sink in water, this fact alone is commonly, although improperly, regarded as sufficient evidence of still-birth. This is assuredly putting the most humane interpretation on the circumstances, and, so far, the result is not to be objected to; but we should take care, in carrying out this principle, that we do not throw obstacles in the way of a subsequent judicial inquiry, and lead to the concealment of crime. Bernt met with an instance in which a seven months' child died *two hours* after birth; and when its lungs were divided and placed in water, every portion sank. Remer has reported another, in which the lungs sank in water, both entire, as well as when divided, although the child had survived its birth at least *four days.* (Henke, 'Lehrb. der Gerichtl. Med.,' p. 374.) In this case the navel-string had separated naturally before death. Orfila found in a child which had lived *eleven hours*, every portion of the lungs, when divided, to sink on immersion. In three other instances in which the children survived birth four, six, and ten hours, the lungs also sank when divided; two of these were mature. ('Méd. Lég.,' vol. 1, p. 375.) Other cases of a similar kind are reported by more recent writers. ('Ann. d'Hyg.,' 1878, t. 2, p. 489.)

Vernon attended a healthy woman, who was delivered of a female child at about the *sixth month* of her pregnancy. The child was born before his arrival, and he heard it crying strongly from under the bed-clothes as he entered the room. After removal from the mother, the child cried at intervals, and it was observed that its chest rose and fell as in ordinary breathing. It lived five hours, and it then appeared to die from feebleness and exhaustion. It was very small; weighing 2 lb. 13 oz., and its length was 12¾ inches; the eyelids were adherent. The lungs were of a purplish-red colour, and slightly overlapped the bag of the heart; they sank in water both entire and when divided into small pieces, were not crepitant, and broke down under firm compression. There was no appearance of air-cells in a section of the lungs when examined with the microscope. The ductus arteriosus and foramen ovale were in their fœtal state. ('Lancet,' 1855, i. p. 121.) A more remarkable case occurred to Donders. (Rep. by Moore, 'Dub. Med. Press,' Nov. 22, 1865, p. 456.) The body of the child was sixteen inches in length, and weighed nearly five pounds. It was probably a seven months' child. The lungs were of a brown colour, and sank in water entire and when divided. There was no crepitation, and on pressure only a reddish fluid without air escaped. The bladder was empty; there was no food in the stomach, but there was meconium in the larger intestine. From this state of facts, Donders concluded that the child was immature—still-born—only a short time dead, and remaining in the womb only a short time after death. It transpired, however, that the child had been born alive, had survived its birth twelve hours, and had cried distinctly after it was born. As the lungs could be readily inflated, and as the child had cried, he concluded that air had been received into the lungs, and had been again slowly expelled, the child dying in a kind of asphyxiated state.

Schwörer delivered a woman in the hospital. The child did not breathe when born, but showed some signs of life. Thus the pulsations of the heart and navel-string were perceptible. These gradually ceased, and no effort could restore the child. On inspection, the lungs were found to contain no air; there was no crepitation when the substance of the lungs was cut, and they sank in water, not only in the entire state, but when divided into numerous pieces. Poncet met with the lungs of a fœtus prematurely born at the Hôtel Dieu. The child had cried, breathed, and lived an extra-uterine life for *ten hours*, but the lungs sank completely in water as if no respiration had taken place. ('Lancet,' 1872, i, 227.) The author may add to these instances two which occurred under his own observation. In one, the case of a mature male child, the lungs sank in water, although the child had survived birth for a period of *six hours*. In the other, the case of a female twin, the child survived *twenty-four hours*; and after death the lungs were divided into thirty pieces, but not a single piece floated, showing therefore that, although life had been thus protracted, not one-thirtieth part of the structure of the lungs had received, by respiration, sufficient air to render it buoyant. ('Guy's Hosp. Rep.,' 1837, ii. pp. 346, 355.) In the latter instance no particular remark was made during life respecting the breathing of the child.

These cases show clearly that buoyancy of the lungs is not a necessary consequence of a child having lived and breathed for some time after birth. Probably, had they called for medico-legal inquiry, the lungs would have been cut to pieces; the sinking of the divided pieces in water, either before or after compression, would have been set down as negativing the act of respiration, and, unless other strong evidence had been forthcoming, it would have been asserted that the children had been born dead. Here, again, we perceive the necessity of not hastily assuming that a child has been *born dead*, because its lungs *sink* in water. There may be no good medical evidence of such a child having lived after birth, but assuredly the mere sinking of these organs does not warrant the common and positive dictum that the child was necessarily dead when born.

It must be apparent, on reflection, that cases of this description are beyond the reach of the hydrostatic as well as of all other tests applied to the respiratory organs; because the lungs do not receive and retain a sufficient quantity of air to give buoyancy after death, although the children may have lived some hours. The hydrostatic test is no more capable of showing that such children as these have lived, than it is of indicating from what cause they have died. Facts of this kind demonstrate that a passive existence may be for some time maintained under a state of the respiratory process not to be discovered after death. In the opinion of some, these cases form a serious objection to the hydrostatic test; but it is difficult to understand how they can affect its general application, or why, because signs of respiration do not always exist in the lungs of children that have lived, we are not to rely upon them when they are actually found. These exceptional instances prove that we are greatly in want of some fact to indicate life after birth, *when the signs of respiration are absent*. Until we discover this we must, of course, make the best use of that knowledge which lies at our disposal, taking care to apply it to those cases alone to which experience shows it to be safely adapted.

It has been recommended that medical jurists should consider as *dead* every child that has not breathed, *i.e. whose lungs sink in water*; but they who give this advice, at the same time admit that children may come into the world living without breathing, and the law holds, under the decision of its expounders, that respiration is only *one* and not an exclusive proof of life. In order to establish life or even live birth, respiration need not always be proved, either in civil or criminal cases (p. 565). A medical jurist would, therefore, be no more justified in asserting that all such children were necessarily born dead, than that they were born living; and in stating what is plain and obvious, it is not possible that his statement can ever be the means of involving an innocent person. It is certain, however, in stating what is contrary to well-known facts, that, when the lungs of a child sink in water, it is safe and just to consider such child as having been born *dead*, he is incurring the risk of exculpating a really guilty person; for it cannot be too strongly borne in mind that a woman is not charged with murder, merely because the lungs of her child float in water, but because there are upon its body marks of violent injuries apparently sufficient to account for its death, or there are strong moral presumptions of her guilt. (See 'Ann. d'Hyg.,' 1836, t. 2, p. 362.) But there is another aspect in which this question should be viewed. There may be no marks of murderous violence on the body of the child, nor any proofs of ill treatment, yet a child born under these circumstances may have died through the culpable neglect or reckless indifference of the woman. Moore, in reporting two cases of atelectasis, in one of which a child had survived its birth twelve hours, remarks that when such a child is deserted or exposed, without the necessary attention required for its helpless state, the conditions are precisely fulfilled to cause its death within a few hours under a diminution of temperature and a total expulsion of air from the lungs. He has no doubt that many a child so found, which had met with its death through want of care, is looked upon as not having lived. ('Med. Press,' Nov. 22, 1865, p. 458.) It will be seen hereafter that some of our judges have given a strong exposition of the law, so as to bring cases of this description within the crime of manslaughter.

Floating of the Lungs from other causes than Respiration.—Another series of objections has been urged to the hydrostatic test, based on the fact that the lungs may receive air and acquire buoyancy from other causes than respiration. These causes are two—putrefaction and artificial inflation.

Putrefaction.—The lungs of a still-born child, when allowed to remain in the chest, are slow in undergoing putrefaction; but, nevertheless, they sooner or later acquire sufficient air to render them buoyant in water. When the lungs are putrefied, this will be determined, in general, by putrefaction having extended throughout all the soft parts of the body. The organs, according to the degree of putrefaction, will be found soft, of a dark-green or brown colour, and of a highly offensive odour; and the serous membrane covering the surface will be raised in large visible bladders, from which the air may be forced out by very moderate compression. It has been remarked that, under the same conditions, gaseous putrefaction takes place as rapidly in the liver, heart, and thymus gland of a new-born child, as in the lungs; we should, therefore, notice the general state of the body. The distension of the lungs with gases from putrefaction cannot be easily overlooked or mistaken for the air of respiration. The answer to any objection founded on the putrefied state of these organs must at once suggest itself. It is impossible that any well-informed medical witness can expect to obtain satisfactory evidence from experiments on lungs in such a condition. He should abandon the case, and declare that, in regard to the question of respiration, medical evidence cannot establish either the affirmative or the negative. The fact of his not being able to give the evidence required cannot be imputed as a matter of blame to him, or ascribed to any deficiencies in the hydrostatic test, but is due to purely exceptional circumstances.

In a case reported by Henke, the lungs and other organs in the body of a child were found in an advanced state of putrefaction. A medical witness gave an opinion that the child was born dead, but the prisoner afterwards confessed that it had been born living. The medical opinion could have been no more than a conjecture, the condition of the body not allowing any correct conclusion to be drawn. This fact shows that it is always better to leave a doubtful case as we find it, than to express a positive opinion that the child has been born either living or dead. If on these occasions a witness were simply to assure a jury that medical evidence could not solve the question whether the child had lived or not—if he were to assert, what is really the fact, that his experiments would not allow him to say whether the child had or had not breathed—it is certain that no innocent person would ever be convicted or a guilty person acquitted, upon his evidence. It is his duty to state that doubt, and leave the decision of guilt or innocence in the hands of the court.

Conclusions.—The general conclusions which may be drawn respecting the application of the hydrostatic test in cases of infanticide are the following:—

1. That the hydrostatic test can show whether a child has or has not breathed, but does not enable us to determine whether a child has been born living or dead.
2. That the lungs of children that have lived after birth may *sink* in water, owing to their not having received air, or to their being in a diseased condition.
3. That a child may live for some time when only a small portion of the lungs has been penetrated by air.
4. That a child may survive birth even for twenty-four hours, when no part of its lungs has been penetrated by air.
5. Hence the sinking of the lungs (whether whole or divided) in water is not a proof that a child has been *born dead.*
6. That the lungs of children which have not breathed and have been born dead, may float on water from putrefaction.
7. That the lungs, as situated in the chest, undergo putrefaction very

slowly; that if but slightly putrefied, the gases may be easily forced out by compression, and if much putrefied, either the case must be abandoned or other sources of evidence sought for.

CHAPTER 50.

FLOATING OF THE LUNGS FROM ARTIFICIAL INFLATION.—INFLATION NOT DISTINGUISHABLE FROM IMPERFECT RESPIRATION.—RESULTS OF COMPRESSION.—IMPROPER OBJECTIONS TO THE HYDROSTATIC TEST.—RESPIRATION BEFORE BIRTH.—RESPIRATION A SIGN OF LIFE, NOT OF LIVE BIRTH.—GENERAL CONCLUSIONS.

Artificial Inflation.—It has been alleged that the lungs of a still-born child may be made to assume, by artificial inflation, *i.e.* by blowing air into them, all the characters assigned to those which have undergone respiration. Thus, it is said, a child may not have breathed, and yet the application of the hydrostatic test would in such a case lead to the inference that it had. It will be seen that the force of this objection goes to attack directly the inference derivable from the discovery of air in the lungs. There is only one form under which this can be admitted as an objection, namely, as it applies to lungs which have been inflated while *lying in the cavity of the chest.* Any experiments performed on them after their removal from this cavity can have no practical bearing, since in a case of infanticide we have to consider only the degree to which the lungs may be distended with air by a person who is fairly endeavouring to resuscitate a still-born child. Assuming that the experiment has been successfully performed, and that the lungs have been artificially inflated, they would resemble, in their partial distension with air and other physical characters, those of children which had breathed imperfectly. Like them, they may float on water; but on cutting them into pieces some of these would be found to sink. If the pieces which float are firmly compressed, either by means of a folded cloth or between the fingers, they will lose air and sink. When this pressure is produced under water, it will be seen that bubbles of air escape, but mere pressure with the fingers will not in general suffice to expel the whole. The same result is obtained when the divided portions of lungs which have breathed imperfectly are submitted to pressure. If, however, the act of breathing has been perfectly performed, and the air-cells are well filled, the air cannot be expelled by pressure or by any force short of the destruction of the substance of the lungs. This difference in the effect of pressure has been hitherto regarded as a criterion to distinguish lungs that have fully breathed from those which have been simply inflated; but Braxton Hicks met with a case which shows that pressure will not always effect the expulsion of air artificially introduced into the lungs of a child born dead; hence, by an exclusive reliance on this method, a medical man might be led to infer that a lung artificially inflated had received air by respiration. He delivered a woman of a full-grown child; it was still-born, and there was no effort at respiration. An attempt was made to resuscitate the child, but unsuccessfully, by blowing air into the lungs through a catheter. On inspection, the lungs were observed to be of large size, but they did not present the usual appearances of lungs which had breathed. Although about three-fourths of the organs had received air by inflation, and they were of a pale-fawn colour, like the thymus gland; still, the air was contained in the minute air-cells. They floated on water as well as all the pieces (fifteen or sixteen) into which they were divided. When compressed between the fingers under water, small bubbles of air escaped; but no amount of compression short of destroying their structure caused these pieces to sink. A fact of this kind, although perhaps exceptional, shows that the non-expulsion of air from lungs by compression must not be regarded as an absolute proof of respiration. It must be taken with other circumstances, *e.g.* absolute weight, colour, and presence of developed air-cells, as a fact to show that the child has either breathed or has had its lungs perfectly inflated in a *bonâ fide* attempt to restore life after birth, either by the mother or by some person present at the birth. In these cases, the only course left open to a medical witness is to state that the evidence derived from experiments on the lungs left it uncertain whether the child in question had breathed or had had its lungs artificially inflated.

In concluding these remarks upon the objections to the hydrostatic test, it may be observed that medical practitioners have differed much at different times in their ideas of what it was fitted to prove. About eighty years ago, it would seem that the test was regarded by some as capable of furnishing evidence of murder. Thus we find W. Hunter asking the question, 'How far may we conclude that the child was born alive, *and probably murdered by its mother*, if the lungs swim in water?' From what has already been stated, as well as from the most simple reflection on the circumstances accompanying the birth of a child, it must be evident that the hydrostatic test is no more capable of showing whether a child has been *born alive or dead* than it is of proving whether it has been murdered or has died from natural causes. The test merely serves to furnish in many cases good proof of life from the state of the lungs; and slight reflection will render it apparent that in no case is it susceptible of doing more. Even their utility is much restricted by numerous counteracting circumstances, a knowledge of which is essential to him who wishes to make a practical application of them.

If asked to state in what cases the pulmonary tests are capable of assisting a medical jurist, the answer would be:—First, they will clearly show that a new-born child has lived, when, during its life, it has *fully and perfectly breathed.* Cases of this description form a certain number of those which come before our courts of assize. To them the most serious objections are not applicable; and the few which might be made to the medical inferences are not difficult to answer. Second, they will allow a witness to say that the lungs must have received air, either by respiration or by artificial inflation. These are the cases in which a child has died soon after birth, and where the respiratory changes are but imperfectly manifested in the lungs. They probably form a large proportion of those which fall under the jurisdiction of the criminal law. It might be considered that the qualification in the inference here drawn would neutralize its force; but it must be remembered that there are few instances of actual and deliberate child-murder wherein artificial inflation could become even a possible defence for an accused person. So unusual is this kind of defence, that among the numerous trials for infanticide which have taken place in this country for many years past, we have not been able to meet with a single instance in which it was alleged, as an objection to the medical evidence derived from the buoyancy of the lungs, that the prisoner had inflated them in order to resuscitate her child. The reason is obvious: had such an offence been attempted, the whole of the circumstantial evidence would at once have set it aside. When, in the suspected murder of an adult, a medical man swears that a fatal wound was such that the deceased might have inflicted it on himself, or that the prisoner might have produced it, he is placing the jury in a position very similar to that in which he places them in a case of child-murder, when he says that the child might have breathed, or its lungs might have been artificially inflated. It is not for him to speculate on the probabilities of respiration or of artificial inflation; but it is for the jury to consider whether the accused was or was not likely, under the particular circumstances of the case, to have resorted to an experiment of this nature. It has been suggested that some person might inflate the lungs of a dead child in order to raise a charge of murder against its mother; but this suggestion presupposes, on the part of the criminal, a profound knowledge of the difficulties of medical jurisprudence; and even then the question of *murder* does not depend merely on the presence of air in the lungs. Such a case is very unlikely to present itself. The circumstances of the case will commonly furnish a sufficient answer to such hypothetical views.

The hydrostatic test ought not, therefore, to be lightly condemned or rejected upon a speculative objection, which, in nine-tenths of the cases of child-murder, could not possibly exist. Let it be granted to the fullest extent, that a conscientious medical jurist cannot always draw a positive distinction between the effects of respiration and artificial inflation on the lungs; still, a jury may be in a situation to relieve him from this difficulty.

We know of only one instance in which a medical man declined to make an inspection of the body of a new-born child for the purpose of examining the state of the lungs. (*Reg.* v. *Pitt,* Dorset Sum. Ass., 1859.) The body was found much mutilated and with such injuries as would fully have accounted for the death of the child, assuming it to have been born alive. At the inquest, the coroner suggested that a post-mortem examination should be made; but the chief medical witness declined to make it, as he did not consider it to be necessary. He was then asked by the coroner whether the floating of the lungs would indicate that the child had breathed, to which he replied that *that* theory was now exploded. It seems that the death of the child was so recent that when the body was found it was quite warm. It also became rigid in the usual time. The medical witness relied upon warmth and rigidity in the body as proofs of the child's having been born alive, when it is obvious that these conditions can prove only that the child has been recently living. The neglect to examine the body led to an acquittal. There was no proof of life as the result of breathing, and no evidence to show whether the injuries were inflicted before or after death.

Respiration before or during Birth.—It has been already stated that the pulmonary tests are fitted to prove whether a child has or has not *lived to breathe.* Neither the hydrostatic nor any other test can positively show that the body of a child was entirely *born alive* when the act of breathing was performed. As this is a subject that generally gives rise to some discussion in cases of child-murder, a few remarks are here made on it. First, respiration may be performed while the child is in the womb, after the rupture of the membranes—the mouth of the child being at the os uteri. This is what is termed *vagitus uterinus;* its occurrence, although extremely rare, rests upon undisputed authority. Second, a child may breathe while its head is in the vagina, either during a presentation of the head or of the breech. This has been termed *vagitus vaginalis.* It is not very common, but it is a possible occurrence. Third, a child may breathe while its head is protruding from the outlet; in this position respiration may be as completely set up in a few moments by its crying, as we find it in some children that have actually been born and have survived their birth for several hours. This is the most usual form of respiration before birth. In the *vagitus uterinus* or *vaginalis,* the lungs receive but a very small quantity of air; in respiration after protrusion of the head, the lungs may be sometimes found moderately well filled, although never, perhaps, possessing all the characteristics of those which have fully breathed. The well-known occurrence of respiration under either of these three conditions strikingly displays the fallacy of making this process the certain boundary of extra-uterine life. A child may breathe in the womb or vagina, or with its head at the outlet, and die before its body is born: the discovery of its having respired would not, therefore, be any sort of proof of its having enjoyed what has been termed 'extra-uterine life.' (For a well-marked case of this kind, see 'Lond. Med. Gaz.,' vol. xxxviii. p. 394; and another in 'Guy's Hosp. Rep.,' 1850, p. 231.) The death of a child which has breathed in the womb or vagina, from natural causes before its entire birth, is a possible occurrence; but its death from natural causes before birth, after it has breathed by the protrusion of its head from the outlet, is an unusual event. All that we can say is—it may take place; but death under these circumstances would be the exception to a very general rule. Oberkamp states that, in four successive deliveries of the same woman, the children breathed during delivery, but died before they were born.

Respiration a Sign of Life, not of Live Birth.—The hydrostatic test is only capable of determining that *respiration has taken place:* it cannot show whether this process was established during birth or afterwards. The fact of a child having the power of breathing before it is entirely born does not, therefore, constitute the smallest objection to its employment; although, upon this ground, we find the use of it, in any case, denounced by some members of the medical and legal professions. It is obvious that most members of the law who have treated this subject have adopted, without sufficient examination, the statements of W. Hunter, who observes: 'A child will commonly breathe as soon as its mouth is born or protruded from its mother; and in that case may lose its life before its body be born, especially when there happens to be a considerable interval between what we may call the birth of the child's head and the protrusion of its body. And if this may happen where the best assistance is at hand, it is still more likely to happen when there is none—that is, where the woman is delivered by herself.' ('On the Uncertainty of the Signs of Murder in the Case of Bastard Children,' p. 33.) Hunter here exposes, in plain language, the fallacy of trusting to the signs of respiration alone, as evidence of a child having been *born* alive. The truth of his remarks is, in the present day, generally admitted; and if, among medical and legal writers, we find some treating respiration as a certain proof of *live birth*, it is from their not having sufficiently considered the probability of a child breathing and dying before its body is entirely extruded.

Although the test can prove no more than that a child has breathed, some medical witnesses, in giving evidence in cases of child-murder, have fallen into the error of assuming that the hydrostatic test is capable of proving 'live birth.' Medical jurists of repute have sanctioned this erroneous view, ignoring the fact that the child may breathe and die before the entire birth of the body, while the test cannot show whether the act of breathing was performed during birth or afterwards. Among others, Casper expressed his opinion that, if we find air in the lungs of a new-born child, such a child must have been born alive. The reasoning of Casper is as extraordinary as his conclusion. He says:—1. During a rapid delivery those conditions are wanting which lead to breathing *in utero* or during birth. 2. All cases of secret delivery are rapid, and it is in these cases only that the hydrostatic test can be applied to the lungs; hence the proof of breathing in a secretly born child must be regarded as breathing after, and not in or during birth. ('Gerichtl. Med.') It will be seen that this medical jurist entirely ignored the facts pointed out by W. Hunter more than eighty years ago, and accumulated by numerous obstetric authorities since that time. On a trial for child-murder, a medical witness, being asked on what he based his statement that the child had been born alive, said, 'The presence of air in the lungs,' and quoted Casper as his authority. There may be cases in which the signs of full respiration would justify an opinion of live birth, but the dictum of Casper is quite inadmissible. The floating of the lungs in water may be owing to air received before or during birth, and it cannot be admitted that all cases of secret delivery are necessarily rapid cases—so rapid that the child has had no time to breathe until after entire birth.

(The reader will find a good summary of the mode of applying the hydrostatic test, as well as of the conclusions which may be drawn from its proper application, by Devergie, in 'Ann. d'Hyg.,' 1872, t. 2, p. 169. *See* also a paper by Tardieu, 'Ann. d'Hyg.,' 1867, t. 2, pp. 217 and 365.)

Conclusions.—The general conclusions respecting the employment of the hydrostatic test, to be drawn from the contents of this chapter, are—

1. That the artificial inflation of the lungs of a child born dead will cause them to float in water.

2. That lungs artificially inflated while in the chest, resemble those organs in which respiration has been only imperfectly established.

3. That in cases of inflation of the lungs in the chest, the air may be *generally* expelled from the divided portions of lung by firm compression so as to cause them to sink.

4. That the same result occurs with lungs in which respiration has been imperfectly established.

5. That when lungs have undergone perfect respiration, the air cannot be expelled by compression of the divided parts, so as to cause them to sink.

6. That the artificial inflation of fœtal lungs causes no alteration of weight, and as the weight increases in proportion to the degree of respiration, so in healthy lungs, with great buoyancy, there should be great weight if the air has been derived from respiration.

7. That we should base our judgment of a child having breathed, upon great weight and great buoyancy of the lungs combined; that the one condition without the other is open to the objection that the air may not have been derived from respiration.

8. That the floating of the lungs in water proves, *cæteris paribus*, that a child has breathed either at, during, or after birth; it does not prove that a child was born alive or that it has died a violent death.

9. That the sinking of the lungs, as a result of the expulsion of air from them by compression, does not necessarily prove that the child was born dead. It merely proves that the air contained in them was derived either from artificial inflation or from the imperfect establishment of the respiratory process.

10. That the hydrostatic test is not applicable to determine the fact of respiration or non-respiration in all cases of alleged child-murder; but that, with ordinary precautions, it may be safely employed in the majority of such cases.

11. That a child may breathe before, during, or after birth; but the hydrostatic test will not enable us to say, in the greater number of cases, at which of these periods the act of breathing was performed.

12. That breathing is a sign of life, and not necessarily of live birth.

13. Hence, in order to constitute murder, medical evidence is required to show whether a child had breathed *after* it was entirely born, and

whether the act of violence which caused its death was applied to it while so breathing.

Some of these conclusions may require qualification; but for the circumstances which qualify them the reader is referred to the contents of the chapter.

CHAPTER 51.

ON THE PROOFS OF A CHILD HAVING BEEN BORN ALIVE.—EVIDENCE FROM RESPIRATION.—FROM MARKS OF VIOLENCE.—FROM NATURAL CHANGES IN THE FŒTAL VESSELS.—FROM THE DISCOVERY OF AIR AND FOOD IN THE STOMACH AND BOWELS.—EAR-TEST.—GENERAL CONCLUSIONS.

ON a trial for child-murder, the important medical question has hitherto been—Was the child completely born alive? The interpretation set upon these words by all the judges is that the whole body of a child should be entirely delivered from the body of the mother before the question of its death from violence could be entertained. In a case in which death had obviously taken place from criminal violence, the medical witness was suddenly stopped in his evidence by being asked for some infallible proof of live birth in a *legal* sense. As a medical man not present at the delivery could rarely be in a condition to offer such proof, the case broke down, and the accused was acquitted. With such technical facilities for evading the law, it is not surprising that cases of alleged infanticide should be so frequent.

By the existing law, it is murder to cause a child to die after it is born by injuries inflicted on it before or during birth; but it is no offence to kill a living child while it is being born, unless miscarriage is caused. Under the proposed new Criminal Code there is the following provision against the murder of *unborn children*: 'Every one shall be liable to penal servitude for life who causes the death of any living child which has not proceeded in a living state from the body of its mother by any act or omission which would have amounted to murder if such a child had been fully born.' For the protection of medical men who perform craniotomy, or who otherwise destroy an unborn child, it is proposed that no one shall be guilty of any offence who, by means employed in good faith, for the preservation of the life of the mother of the child, and reasonably necessary for that purpose, causes the death of any such child or causes any child to die after it is fully born by any such thing done before or during its birth. This proposed change may be objected to on a technical ground—namely, that it creates a difference in the crime of murder, making it to depend, not on the fact of killing, but on the time at which the killing takes place. The answer to this objection is, however, that, under the present law, many escape who deserve punishment, and that real cases of child-murder practically go unpunished. Under the proposed Code, juries would be less ready to acquit women charged with this crime when a sentence of penal servitude can be passed on them in place of capital punishment.

As the question of live birth must still, as a rule, be put to the witness on charges of child-murder, it will be necessary to consider the medical facts upon which reliance can be placed, as furnishing evidence of a child having come into the world living, or of its having been born alive.

Evidence from Respiration.—As a general rule, there will be no perceptible difference in the state of the lungs, whether the act of respiration is performed by a child during birth or after it is born, provided that its death speedily follows its birth. But should we find that this process has been *perfectly established*, *i.e.* that the lungs present all those conditions which have been described as characteristic of full and perfect breathing, there is great reason to presume that the process, even if it had commenced during birth, must have continued after the child was entirely born. This presumption becomes still stronger when the child is immature; for, generally speaking, such children must be born and continue to breathe for many hours after birth, in order that their lungs should present the characters of complete respiration. The process is seldom so established before birth as to give to these organs a feeling of crepitation under pressure; the existence of this character should, therefore, be sought for. A witness who relied upon it as a conclusive proof of breathing *after* birth, might be asked whether it were not possible for some children to remain so long at the outlet with the head protruding, as to render the lungs crepitant from frequent respiration *before* birth. Admitting the possibility of this occurrence, he should endeavour to ascertain whether there was any probable cause which could thus have protracted delivery while the head of the child was in this position; as also what natural cause could have produced its death when its head was protruding and respiration had been so freely performed as to give crepitation to the lungs. The presence or absence of the usual scalp-tumour might throw some light upon the case. If, when present, it did not prove live birth, it might indicate protracted delivery, and show that the child had been recently living. Casper cut the Gordian knot of this difficulty by assuming that breathing before birth takes place only in protracted delivery, in which the assistance of an accoucheur is required. In those cases which are likely to give rise to criminal investigations, he assumed that the birth of the child takes place quickly, and that in rapid delivery the child does not breathe until after it has been born alive. Hence his conclusion is—if in the body of a child (secretly disposed of) the lungs are found by the hydrostatic test to contain air, this air did not enter the lungs at or before birth, but afterwards, and that the child was born alive. ('Gerichtl. Med.') Such a conclusion is not in accordance with the facts ascertained regarding the act of respiration in new-born children; it may be that they rarely die from natural causes after they have once breathed, but that they can breathe and cry during birth is a fact which cannot be disputed. Further, there is no test known by which air received into the lungs during birth can be distinguished from that which has entered these organs after the child has been born alive.

Evidence from Marks of Violence.—If marks of violence, apparently inflicted about the same time, are found on different and remote parts of the body, and these marks bear the characters of those produced during life, it is rendered probable that the whole of the body of the child was in the world when they were caused. Marks of great violence on one part, as the head or breech, would not always justify such a presumption, because it might be fairly objected that they had been unintentionally produced by the woman in her attempts at self-delivery, and yet the child not have been born alive. It would be for a witness to form an opinion, from the circumstances accompanying the particular case, whether they had been thus occasioned. From this it will be seen that, in making an examination after death, every mark of injury on the body of a child, even if slight, should be noted down. Abrasions of the skin, burns, and punctures, should be sought for, and the throat examined for marks of pressure by a cord or by the fingers.

Evidence from Certain Changes in the Body.—In a child that has been born alive, or has survived its birth for a period of from twelve to twenty-four hours, that portion of the umbilical cord (navel-string) which is contiguous to the abdomen undergoes certain changes: it dries and becomes slowly shrivelled, and in from three to five days it separates from the body, with or without cicatrization.

The cord does not separate at the part which is tied, but close to the abdomen. It separates generally within five days, by a process of sloughing, the skin connected with the dead portion of the cord presenting a red line, arising from capillary congestion. During the separation of the navel-string the umbilical vessels are gradually closed. According to Billard, the obliteration of these vessels is effected in a peculiar manner. The calibre diminishes as a result of a concentric thickening of the coats, so that, while the vessel retains its apparent size, its cavity is gradually blocked up. A quill would represent the form of the vessel in the fœtal state, and a tobacco-pipe in the obliterated state. It is only by cutting through the vessel that the degree of obliteration can be determined. The state of the *umbilical cord* has furnished good evidence of live birth, when the other circumstances of the case have yielded no information. The changes in the umbilical cord, especially those indicative of its separation and cicatrization, clearly prove that a child has survived its birth, whatever may be the results of experiments on the lungs; but the difficulty is that they require some days for their production, and in practice it is necessary to procure some sign of survivorship for only a few minutes, or at furthest for a few hours. The same remark applies to the *exfoliation of the cuticle* in a new-born child: such a condition of the skin can rarely be found in cases of infanticide. The absence of meconium from the intestines, and of urine from the bladder, are not proofs of live birth, for these may be discharged during birth, and yet the child not be born alive.

State of the Skin.—In the greater number of new-born children, the skin has a dark-red colour, probably owing to the first effect of the atmosphere upon it. Within an hour it begins to get of a lighter red, and so it remains for one or two days. According to Elsässer, it becomes again darker about the end of the second or on the third day, and is then of a brownish-red colour. This lasts for three or four days, unless a yellowness appears from jaundice. It is then more or less yellow. It is about the sixth or seventh day that the skin acquires the reddish-white colour such as it afterwards retains. (Henke's 'Zeitschr. der S. A.,' 1842, vol. 2, p. 223.)

Evidence from Changes in the Heart and Fœtal Vessels. Docimasia Circulationis.—It has been supposed that the state of the ductus arteriosus, ductus venosus, and foramen ovale would aid a medical jurist in forming an opinion whether a child had survived its birth. In general, as a result of the establishment of respiration, it is found that the communication between the auricles of the heart by the foramen ovale becomes closed; and that the two vessels or ducts, after gradually contracting, become obliterated or are converted into fibrous cords. Whatever may be the conclusions from experiments on the lungs, it has been contended that the closure of the foramen and of these vessels would infallibly indicate that a child had breathed. This inference, however, has been too hastily drawn. Researches have shown that there are some serious objections to any conclusions based on the state of these fœtal vessels; their closure, as a natural process, always takes place slowly, and sometimes is not completed until many years after birth. Thus, then, in the generality of cases of infanticide, in which necessarily the child survives but for a short period, no evidence of the fact will be procurable from an examination of the heart and fœtal vessels.

As a general rule, the peculiar parts of the fœtal circulation are rarely obliterated by a normal process before the eighth or tenth day after birth. The obliteration follows no certain order. The statistical facts collected by Elsässer prove that the vessels peculiar to the fœtal circulation remain open as a rule for some time after birth, and that it is not possible to determine accurately, by days, the period of their closure. The closure commenced and was often completed in the ductus venosus, before it manifested itself in the other vessels. The complete closure, in by far the greater number of cases, takes place within the first six weeks after birth, and the instances of obliteration before birth, or before the period mentioned after birth, must be regarded as rare exceptions. ('Med. Times and Gaz.,' 1853, i. p. 530.)

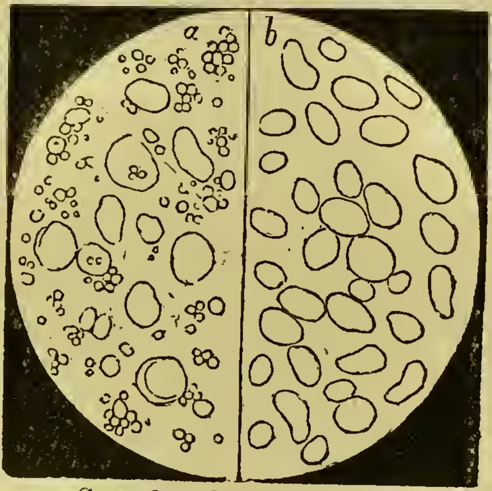
From these facts, the docimasia circulationis may be considered as useless to a medical jurist. It either proves nothing or it may lead to a fatal error. It is the more necessary to point out the fallacies to which it is liable, because hitherto medical jurists have been disposed to place great reliance upon it, in cases in which medical evidence from the state of the lungs was wanting.

Evidence from the State of the Alimentary Canal.—The presence of frothy air-bubbles in the glairy contents of the stomach of a new-born child was thought by Tardieu to indicate live birth for ten or fifteen minutes at the least; but the same frothy condition might be produced by attempts to inflate the lungs. Breslau found that in still-born children, no air is found in the stomach or intestinal canal; hence the stomach and bowels as a whole sink in water. The presence of air in the stomach depends on respiration, and probably reaches the stomach with the first attempt to respire. As breathing proceeds, the air finds its way into the intestines; hence the stomach and bowels float in water when the child has respired. The lower the portion of the bowels that floats in water, the greater is the probability that the child survived its birth. ('Ann. d'Hyg.,' 1868, t. 2, p. 224.)

Good evidence of live birth may be sometimes derived from the discovery of certain liquids or solids in the stomach and intestines, such as blood, milk, or farinaceous or saccharine articles of food; for it is not at all probable that these substances should find their way into the stomach or intestines of a child which was really born dead.

1. *Starch.*—In the case of a new-born child, Geoghegan discovered, by the application of iodine-water, the presence of farinaceous food in the contents of the stomach; hence the question of live birth was clearly settled in the affirmative. On another occasion, Francis employed this method of testing, with satisfactory results, in a case in which the investigation was beset with unusual difficulties. He was required by the coroner to examine the body of a new-born child found under suspicious circumstances. The examination of the lungs left no doubt that respiration had taken place; and the fact that the child had been born alive was fully established by the discovery, in the stomach, of a small quantity of farinaceous food. On digesting in distilled water a fragment of the pulp found in this organ, and adding a drop of a solution of iodine, an intense indigo-blue colour appeared immediately. The application of this chemical test, therefore, removed any doubts which might have been entertained on the question of live birth. ('Lond. Med. Gaz.,' vol. xxxvii. p. 460.) The editor met with a similar case. The quantity of starch present may, however, be too small to produce with water a solution which would be coloured by iodine in the manner described. A portion of the contents of the stomach should be placed on a glass slide, diluted with a little water, if viscid, and examined under the microscope with a power of about 300 diameters. The granules (if present) may then be distinctly seen, having the shape peculiar to each variety of starch, and not unfrequently mixed with oil-globules and epithelial scales derived from the mucous membrane. By the addition of iodine-water, their shape and size will be brought out by the blue colour which they acquire. Blue

Fig. 50.



a. Granules of Wheat-starch. *b.* Granules of Arrowroot.
Magnified 319 diameters.

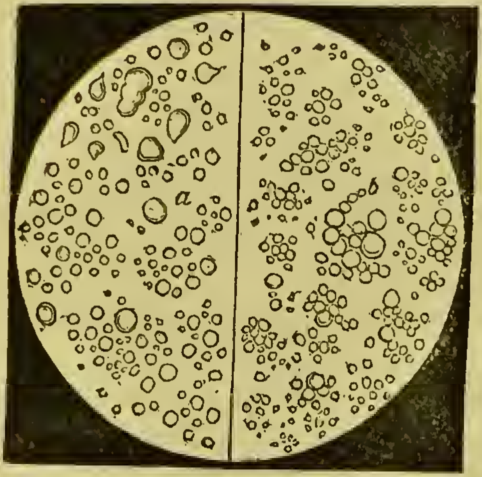
fragments of an irregular shape indicate the presence of bread. The annexed engraving (Fig. 50) represents two varieties of starch, either of which may be found in the stomachs of infants: in *a*, the rounded granules of wheat-starch are represented; and in *b*, the ovoid granules of arrowroot. The micrometrical measurements of these granules show, for those of wheat, which are irregularly spherical, diameters varying from 0·00011 to 0·00089 inch in size; many have an average diameter of 0·00033 inch. The ovoid granule of arrowroot is 0·00111 inch in length, and 0·00056 inch in width.

2. *Sugar.*—In a case which the author was required to examine, the presence of sugar was readily detected in the contents of the stomach by the application of Trommer's test. In order to apply this test, a few drops of a weak solution of sulphate of copper should be added to a portion of the cold concentrated aqueous extract of the contents of the stomach. An excess of a solution of caustic soda is then added, and the liquid boiled. If grape-sugar be present, suboxide of copper is immediately precipitated of a yellowish or reddish colour. With white cane-sugar the same precipitation is effected only when the solution is first boiled with dilute hydrochloric acid. If starch only is present, black oxide of copper may be thrown down, but there will be no production of a red precipitate. The formation of the red oxide of copper under these circumstances proves that some saccharine substance is present. In reference to the application of the sugar-test, however, it must be remarked that starch is easily convertible into maltose and grape-sugar by a chemical action of saliva or mucus, so that the test may appear to indicate sugar in small quantity, when the result may be really due to the presence of some converted starch.

3. *Milk.*—This liquid may be found in the stomach of a new-born child; it may be identified by the microscope in the fluids of the stomach by the numerous and well-defined oil-globules which it contains. It is not possible to distinguish human from cow's milk under these circumstances. In both, the globules, which are spherical in all aspects (Figs. 51 and 52), are remarkable for their transparency in the centre, and their dark margins. They vary considerably in size. The author found those of the cow to have by measurement the following diameters:—Maximum, 0·00045 inch; minimum, 0·00006 inch; and medium size, 0·00022 inch. They are distinguished from blood-corpuscles by their shape and lustre, and from starch-granules by the fact that they are not coloured or changed by iodine-water. *Colostrum* is the name applied to the milk first secreted after delivery; it contains, in addition to oil-globules, numerous spherical granular bodies (Fig. 52, *b*). When milk is present, milk-sugar is generally found in the contents of the stomach by the appropriate sugar-test (*supra*). The casein of milk precipitates sulphate of copper; but on adding an excess of a solution of soda, the precipitate is redissolved, forming a purple or violet-coloured solution. It is rapidly coagulated by the digestive principle (pepsin) contained in the gastric juice, so that the casein may be found in small soft masses adhering to the lining membrane of the stomach. It should be observed that

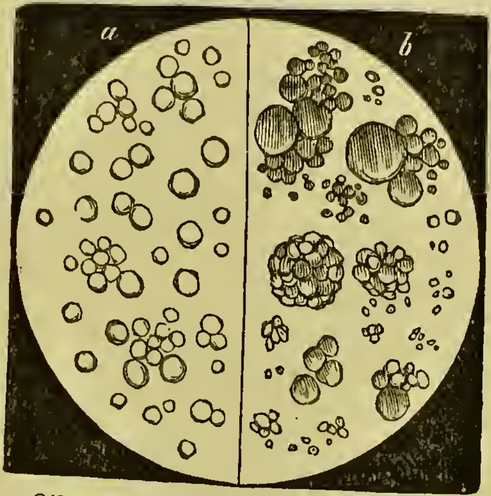
albumen forms a deep violet-coloured solution with sulphate of copper and soda, but the red suboxide of copper is not precipitated on boiling unless sugar is mixed with it.

Fig. 51.



Oil-globules of Human Milk. Oil-globules of Cow's Milk.
Magnified 319 diameters.

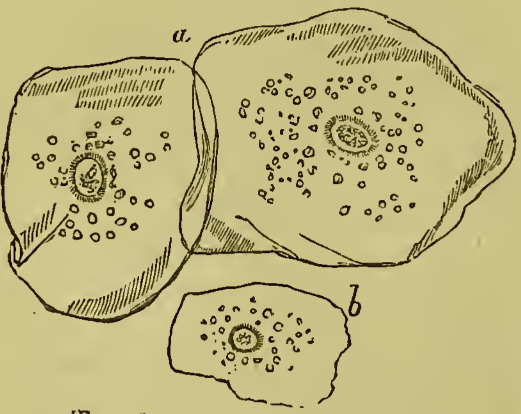
Fig. 52.



Oil-globules of Human Milk. Colostrum with granular bodies.
Magnified 450 diameters.

4. *Epithelial Scales.*—The epithelial scales commonly found associated with articles of food in the stomach are of various shapes and sizes; they are flat, oval, or rounded, and sometimes polygonal. They are nucleated, and from their pavement-like appearance they are called 'tesselated.' In Fig. 53, *b*, an epithelial scale from the mucous membrane of the inside of the mouth is represented magnified 570 diameters. In the long axis it was 0·002 inch, and in the shortest 0·0011 inch in diameter. The central nucleus was 0·00025 inch in diameter, and the small granules around it 0·00011 inch. These epithelial scales are very numerous, much intermixed, and so thin and transparent that they are often only distinctly seen at the edges, which are occasionally folded or slightly turned over.

Fig. 53.



Tesselated Epithelial Scales: *a*, from Sharpey; *b*, from observation.

Besides the substances mentioned, other solids and fluids, such as blood and meconium (the fæcal discharges of the fœtus), may be found in the stomach of a new-born child, and a question may arise whether their presence indicates that the child was fully born. It is not impossible that a child might be fed and might exert a power of swallowing when its head had protruded from the outlet, and its body was still within the body of the mother. Children have been known to exert a power of sucking or aspiration under these circumstances, and, with this, a power of swallowing might be exercised. In defending a prisoner on a charge of child-murder, counsel would scarcely resort to a defence of this kind. That the starch, sugar, or milk, &c., found in the stomach should have been given to a child when its body was only half born, is so improbable an hypothesis that the most inexperienced lawyer would hardly resort to it to account for the presence of food in this organ. When the substances found in the stomach are not in the form of food, but are fluids connected with the child or the mother, the case is different. These may penetrate into the lungs or stomach during birth, either by aspiration or by the act of swallowing; they thus indicate that the child was living, but they do not necessarily show that its body was entirely in the world when they were swallowed.

5. *Blood.*—An instance is related by Döring in which a spoonful of coagulated *blood* was found in the stomach of a new-born child. The inner surfaces of the gullet and windpipe were also covered with blood. Döring inferred from these facts that the child had been born alive; for the blood, in his opinion, could have entered the stomach only by swallowing, *after* the birth of the child, and while it was probably lying with its face in a pool of blood. Taken alone, however, such an inference would not be justifiable from the facts as stated. Blood might be accidentally drawn into the throat from the discharges of the mother during the passage of the child's head through the outlet, and yet the child may not have been born alive. The power of swallowing may be exerted by a child during birth, either before or after the act of breathing. This power appears to be exerted even by the fœtus *in utero.* Blood may be recognized in the contents of the stomach, not only by the colour which it imparts to the mucous liquids present, but by the aid of the microscope.

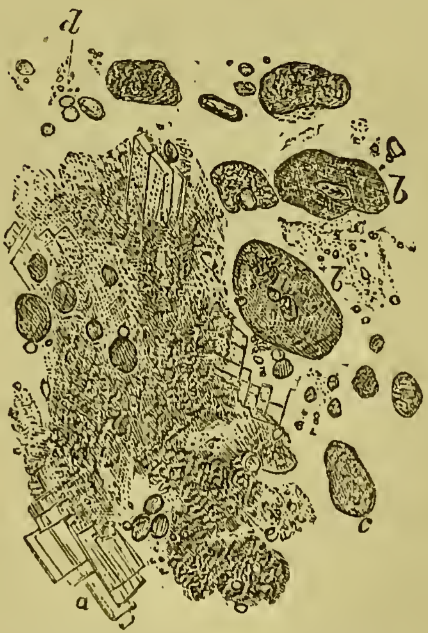
Robinson has made some researches on the contents of the fœtal stomach during uterine life. He finds that the substances which naturally exist in the stomach of a fœtus before birth are of an albuminous and mucous nature. His observations were made on the stomachs of two human fœtuses, and on those of the calf, lamb, and rabbit. The conclusions at which he arrived were—that the stomach of the fœtus, during the latter period of its uterine existence, contains mucous and albuminous matters derived from the salivary secretion; and that gastric juice is not secreted until after respiration has been established. The medical jurist will perceive, therefore, that the discovery of farinaceous food, milk, or sugar in the stomach will furnish evidence of birth, since substances of this kind are not found naturally in this organ.

6. *Meconium.*—This name is applied to the excrementitious matter produced and retained in the intestines during fœtal life. It may be found in the stomach of a new-born child, and a question will thence arise whether its presence there should be taken as a proof of entire live birth. It may be discharged from the child during delivery, in cases in which there is a difficult or protracted labour. During the act of breathing it may enter the throat with other discharges, and thus

be found in the stomach. That a breathing child can thus swallow meconium cannot be disputed, but, assuming that, in the body of a child which has not lived to breathe, this substance is found in the air-passages and stomach, how is the conclusion affected? From a case which occurred to Fleischer, it is probable that some portion of the meconium may be discharged from the bowels of a child during labour, and, as the mouth passes over this liquid, a portion may be drawn into the throat by aspiration. When once there, the instinctive act of swallowing would immediately convey a portion of it into the stomach. (See case in 'Vierteljahrsschr. für Gerichtl. Med.,' 1863, vol. 1, p. 97; also for another case, 'Med. Times and Gaz.,' 1861, ii. p. 116.)

The presence of fluids, therefore—such as *blood, meconium,* or the watery discharges attending delivery—in the stomach and air-passages of a new-born child, does not prove live birth, but merely indicates the existence of some living actions in the child at or about the time of its birth. A woman was suddenly delivered of a child while sitting over a slop-pail of dirty water. On examining the body, it was obvious that it had not breathed. There was no air in the lungs, but a quantity of dirty water like that in the pail was found in the stomach. This could have entered the organ only by the act of swallowing, and, in Ramsbotham's opinion, the child had swallowed the liquid under some fœtal attempt to breathe. The coroner who held the inquest directed the jury that the child was born dead: but most physiologists will consider that the power of swallowing cannot be exerted by a dead child; and as its body must have been entirely delivered in order to have fallen into the liquid, there was proof that it had been born living, and that in this instance it had died after it was entirely born, by the prevention of the act of breathing. The facts connected with the aspiration of liquids by new-born children have been lately fully examined by Hofmann. ('Vierteljahrsschr. für Gerichtl. Med.,' 1873, vol. 2, p. 228.)

Fig. 54.



Microscopical appearances of Meconium: *a*, crystals of cholesterin; *b*, epithelial scales; *c*, masses of green colouring matter of bile (biliverdin); *d*, *e*, granules; magnified 400 diameters.

The *meconium* may be generally recognized by its dirty-green colour and general appearance, as well as by the absence of any offensive odour, which it does not acquire until after the third or fourth day from birth, when it becomes mixed with feculent matter. Its microscopical characters are represented in the above engraving (Fig. 54). In the air-passages it is sometimes associated with vernix caseosa, and hairs derived from the skin. ('Med.

Times and Gaz.,' 1861, i. p. 591, and 1861, ii. p. 117; see also 'Ann. d'Hyg.,' 1855, t. 2, p. 445.)

But little need be said on its chemical properties; still, as the detection of stains of meconium on clothing may occasionally form a part of the medical evidence, a few observations are here required. The stains which it produces are of a brownish-green colour, very difficult to remove by washing. They stiffen the stuff, and are usually slightly raised above the surface, without always penetrating below it. Meconium forms with water a greenish-coloured liquid, having an acid reaction, and a boiling temperature does not affect the solution. Nitric acid and sulphuric acid with sugar yield with it the green and red-coloured compounds which they produce with bile. Cholesterin may be separated from it by hot ether.

Huber has recently subjected meconium to an elaborate investigation. According to him, the most important substance, medico-legally considered, met with in meconium is a greenish-yellow body which gives it its dark-green colour. These bodies are admirably depicted by Tardieu. ('Sur l'Infanticide,' plate 2.) They are oblong, elliptical, of oval or roundish contour, not unfrequently flaky and with rounded angles, and are very variable in size, some being excessively minute, others as large as the epithelial cells depicted in Fig. 53, p. 591. They are homogeneous in structure, and, being enveloped in mucus, it is difficult to ascertain the action of chemical reagents upon them; but they are unaltered by acetic acid and solution of potash, but soluble in ether. Huber held that the discovery of these bodies in stains is characteristic of the presence of meconium. (Friedreich's 'Blätter für Gerichtl. Med.,' 1884, pp. 24, 142.) Huber's memoir contains a complete bibliography of all that relates to meconium.

It may be remarked, in reference to stains produced by the fæces of a child which has survived birth, that until the fifth or sixth day they retain a dark-green or greenish-yellow colour. On the seventh day after birth, they generally acquire a bright-yellow colour, like that of the yolk of egg; and, if the child is in health, they will retain this colour during all the time that it is suckled.

7. *Ear-test.*—Wreden has pointed out that the middle ear of a new-born child is filled with epithelial cells or metamorphosed embryonal connective tissue; and that this becomes absorbed or removed shortly after birth if the child be alive. The presence of a distinct cavity in the middle ear hence becomes an important factor in determining that a child has survived its birth. ('Lancet,' 1877, ii. p. 741.) The editor has found this test useful in several cases.

The slightest consideration will show that the various indications of live birth above described are weak, and of purely accidental occurrence. If a child is destroyed either during birth, or within a few minutes afterwards, there will be no medical evidence to indicate the period at which its destruction took place: the external and internal appearances presented by the body will be the same in the two cases. It is most probable that, in the greater number of instances of child-murder, a child is actually destroyed either during birth or immediately afterwards; and, therefore, the characters above described can rarely be available in practice. If any exception is made, it is with respect to the nature, situation, and extent of marks of violence; but the presence of these depends on mere accident. Hence, then, we come to the conclusion that, although medical evidence can generally show, from the state of the lungs, that a child has really lived, it can rarely be in a condition to prove, in a case of infanticide, that its life had certainly continued after its entire birth. We could only venture upon this inference when the signs of breathing were full and complete, or when some article of food was found in the stomach.

Conclusions.—The general conclusions which may be drawn from the facts contained in this chapter, on the question whether a child has or has not been *born alive*, are as follows :—

1. That if the lungs are fully and perfectly distended with air by the act of breathing, this affords a strong presumption that the child has been *born alive*, since breathing during birth is in general only partial and imperfect.

2. That the presence of marks of severe violence on various parts of the body, if possessing vital characters, renders it probable that the child had been born alive when the violence was inflicted.

3. That certain changes in the umbilical vessels, and the separation (by a vital process) and cicatrization of the navel-string, as well as a general peeling or scaling-off of the cuticle, indicate live birth.

4. That the absence of meconium from the intestines, and of urine from the bladder, are not proofs that a child has been born alive, since these liquids may be discharged during the act of birth.

5. That the open or contracted state of the foramen ovale or ductus arteriosus furnishes no evidence of a child having been born alive. These parts may become closed and contracted *before birth*, and therefore be found closed in a child born dead; or they may remain open after birth in a child born living, even subsequently to the establishment of respiration.

6. That the presence of air and of farinaceous or other food in the stomach and bowels proves that a child has been entirely born alive.

7. That the presence in the stomach and air-passages of blood, meconium, vernix caseosa, or the natural discharges, does not prove that a child was born alive.

8. That the presence of an air-cavity in the tympanum, or middle ear, affords additional evidence of live birth.

9. That, irrespective of the above conclusions, there is no certain medical sign which indicates that a child that has died at or about the time of birth—has been born alive.

CHAPTER 52.

CAUSES OF DEATH IN NEW-BORN CHILDREN.—PROPORTION OF CHILDREN BORN DEAD.—NATURAL CAUSES OF DEATH.—A PROTRACTED DELIVERY.—DEBILITY.—BLEEDING FROM LACERATION OF THE NAVEL-STRING.—COMPRESSION OF THE NAVEL-STRING.—MALFORMATION.—DESTRUCTION OF MONSTROUS BIRTHS.—DEATH FROM CONGENITAL DISEASE.

Causes of Death in New-born Children.—The next important question in a case of infanticide, and that upon which a charge of murder essentially rests, is—What was the cause of death? 1. It is admitted that a child may die during birth or afterwards. 2. In either of these cases it may die from *natural* or *violent causes.* The violent causes may have originated in *accident* or in *criminal design.* The last condition only involves the question of child-murder. If death has clearly proceeded from natural causes, it is of no importance to settle whether the cause operated during or after birth. All charge of criminality is henceforth at an end.

It is well known that of children born under ordinary circumstances a great number die from *natural causes* either during birth or soon afterwards; and in every case of child-murder, death will be assumed to have arisen from some cause of this kind until the contrary appears from the medical evidence. This throws the onus of proof entirely on the prosecution. Many children die before performing the act of respiration, and thus a large number come into the world dead or still-born. The proportion of *still-born* among legitimate children, as it is derived from statistical tables extending over a series of years, and embracing not fewer than eight millions of births, varies from one in eighteen to one in twenty of all births. ('Brit. and For. Med. Rev.,' No. 7, p. 235.) In immature and illegitimate children, forming the greater number of those which give rise to charges of child-murder, the proportionate mortality is much greater—probably about one in eight or ten. Still-births are much more frequent in first than in after-pregnancies; and children are much more frequently born dead among primiparous than among pluriparous women. Males are more often still-born than females. According to Lawrence's observations, the proportion of deaths is 1 to 11 among the primiparous, and 1 to 31·2 among the pluriparous. ('Edin. Med. Jour.,' March, 1863, p. 815.) In most cases of child-murder, the woman is primiparous. These facts should be borne in mind when we are estimating the probability of the cause of death being natural.

Should breathing be established by a protrusion of the child's head from the outlet, or during the birth of the body, the chances of death from natural causes are considerably diminished. Nevertheless, as W. Hunter long ago suggested, a child may breathe and die. Thus, according to this author, 'If the child makes but one gasp and instantly dies, the lungs will swim in water as readily as if it had breathed longer and had then been strangled.' In general, it would require more than one gasp to cause the lungs to float readily in water; but, waiving this point, the real question is—If the child breathed either during or after birth, what could have caused its death? The number of gasps which a child may make, or which may be required for the lungs to swim in water, is of no moment; the point to be considered is, whether its death was due to causes of an accidental or criminal nature. So again observes Hunter: 'We frequently see children born, who, from circumstances in their constitution, or in the nature of the labour, are but barely alive, and after breathing a minute or two, or an hour or two, die, in spite of all our attention. And why may not this misfortune happen to a woman who is brought to bed by herself?' The substance of this remark is that many children may die naturally after having been born alive; and in Hunter's time these cases were not, perhaps, sufficiently attended to. In the present day, however, the case is different: a charge of child-murder is seldom raised, except in those instances where there are the most obvious marks of severe and mortal injuries on the body of a child; and it must be admitted that the discovery of violence of this kind on the body of a new-born infant renders a full inquiry into the circumstances necessary. Among the *natural* causes of the death of a child may be enumerated the following:—

1. *A Protracted Delivery.*—The death of a child may proceed, in this case, from injury suffered by the head during the violent contractions of the womb, or from an interruption to the circulation in the umbilical cord before the act of breathing can be performed. As it is elsewhere explained (*post*, pp. 599, 601), each contraction of the womb affects the placental circulation, and a succession of these contractions in a protracted delivery will have the same effect on the child as the arrest of breathing after birth, *i.e.* non-oxygenated blood will be circulated, and may cause the death of the child. For a similar reason, a premature separation of the placenta may lead to its death.

A child, if feeble and delicate, or if prematurely born, may die from exhaustion under these circumstances before respiration is established. This cause of death may be suspected when a sero-sanguinolent tumour (called *cephalhæmatoma*, or *caput succedaneum*) is found on the head of a child, and the head itself is deformed or elongated as a result of pressure. This appearance will be accompanied with a congested state of the vessels of the brain. The existence of deformity in the pelvis of the woman might corroborate this view; but in primiparous women (among whom charges of child-murder chiefly lie) with well-formed pelves delivery is frequently protracted. It is presumed that there are no marks of violence on the body of the child, excepting those which may have reasonably arisen from accident in attempts at self-delivery.

2. *Debility.*—A child may be born either prematurely or at the full period, and not survive its birth, owing to a natural feebleness of system. This is observed among immature children; and it is a condition especially dwelt on by W. Hunter. Such children may

continue in existence for several hours, breathing feebly, and may then die from mere weakness. These cases may be recognized by the immature condition of the body and the appearance of a general want of development.

3. *Bleeding from Laceration of the Navel-string.*—A child may die from loss of blood, owing to a sudden separation of the placenta, or an accidental rupture of the navel-string. In the latter case, it is said the loss of blood is not likely to prove fatal if breathing has been established; but an instance is reported in which a child died from bleeding even under these circumstances. (Henke's 'Zeitschrift,' 1839, Erg. H., p. 200; also 1840, Bd. 1, p. 347, and Bd. 2, p. 105; 'Ann. d'Hyg.,' 1831, t. 2, p. 128.) Bleeding from the cord has been observed to take place at various periods after birth, and to have led to the death of the child. ('Edin. Month. Jour.,' July, 1847, p. 70.) Death from bleeding may be commonly recognized by the blanched appearance of the body, and a want of blood in the internal organs; but there are several instances on record in which the cord was ruptured close to the abdomen without causing the death of the child. Bleeding from the vessels of the navel-string may prove fatal several days after birth, even when a child has been properly attended to, and the navel-string has separated by the natural process. A case of this kind is reported in which, in spite of every application, the child died from loss of blood six days after the cord had separated. ('Med. Times and Gaz.,' 1854, i. p. 287.) The impossibility of arresting the bleeding in this case appeared to depend upon a great deficiency of fibrin in the blood, and a consequent want of tendency to coagulation. (See a paper by Wieczorek, 'Vierteljahrsschr. für Gerichtl. Med.,' 1873, Bd. 1, p. 385.) It has been believed that the danger arising from bleeding of the cord was chiefly confined to those cases in which it was divided near to the abdomen, and where a cutting instrument had been used; and this is no doubt generally true. Page performed some experiments on this subject, which showed that hæmorrhage might take place from the divided navel-string, even when torn through at a length of eighteen inches from the body, and to such an extent as to endanger the life of a child. He also found that hæmorrhage from the cord might take place without any interference with the respiration; but the arrest of this may lead to hæmorrhage which might not otherwise have occurred.

If there are severe wounds on the body from which blood has issued, it would be obviously wrong to refer a blanched condition of the body to accidental bleeding from the cord. The fatal bleeding may really have arisen from the wounds.

Before a medical expert refers death to this cause, he should be well assured that the cord was really torn through or severed about the time of birth, and not from any accident subsequently. A case is reported which shows the necessity for this caution. The body of a new-born child was taken from a river in which it had probably been floating for nearly a fortnight. The placenta and cord were attached to the body, but in removing it from the water the cord was torn through and the placenta carried away by the stream. A medical man examined the body, and, seeing the cord ruptured, and observing no marks of violence, he came to the conclusion that the cord had been torn through by the woman at birth, and that the child had died from hæmorrhage. ('Ann. d'Hyg.,' 1873, t. 2, p. 443.) The medical opinion, however, was disproved by the evidence of witnesses.

4. *Compression of the Navel-string.*—When a child is born by the feet or buttocks, the cord may be so compressed under strong uterine contraction that the circulation between the mother and child will be arrested, and the latter will die. The same fatal compression may follow when, during delivery, the cord becomes twisted round the neck, A child has been known to die under these circumstances before parturition, the cord having become twisted round its neck in the uterus. ('Lond. Med. Gaz.,' Oct. 1840, p. 122; also vol. lxxix. pp. 232, 233.) Davis reported a case where it is probable that the child, which was heard by the mother to cry for some time, was strangled by the mother having moved her body away from the infant after delivery, and thus tightened the navel-string. ('Brit. Med. Jour.,' 1882, ii. p. 1069.) On these occasions, the child is sometimes described to have died from strangulation, but it is evident that, before the establishment of respiration, such a mode of expression is improper. There are few or no appearances indicative of the cause of death. There may be lividity about the head and face, with a mark or furrow on the neck, and congestion of the brain internally; it is, however, necessary to remember that the brain of a child is always more congested than that of an adult. Hofmann considers that asphyxia is really the cause of death in children which have not breathed. He looks upon the placental circulation as vicarious to that of the lungs after birth, the arterial blood from the woman supplying the oxygen (derived from respiration) necessary to support the life of the unborn child. The amount of oxygen required for this purpose is exceedingly small, and, according to Schwartz and Pflüger, it is not sufficient to produce any difference of colour in the blood of the umbilical vessels. ('Vierteljahrsschr. für Gerichtl. Med.,' 1873, Bd. 2, pp. 219, 224.) Although, under compression of the cord, a child may die before breathing, from the want of a proper supply of oxygen through the blood, yet the appearances presented by the lungs would differ from those which are found in these organs after breathing has been once established.

5. *Malformation. Monstrosity.*—There may be a deficiency or defect of some vital organ which would at once account for a child dying either during delivery or soon after its birth. Two cases are reported, in one of which the child died from an absolute deficiency of the gullet, the pharynx terminating in a cul-de-sac; in the other, the duodenum was obliterated for more than an inch, and this malformation had occasioned the child's death. ('Lond. Med. Gaz.,' vol. xxvi. p. 542.) In a third, a child was suffocated by the retraction of the base of the tongue, owing to defect of the frænum. ('North. Jour. Med.,' 1849, p. 278.) The non-establishment of respiration sometimes arises from the mouth and fauces of the child being filled with mucus.

An enlargement of the thyroid gland has occasionally led to the death of a new-born child by suffocation. ('Edin. Month. Jour.,' July, 1847, p. 64.) The epiglottis is sometimes fixed over the glottis so as to prevent the entrance of air. In a case of this kind which occurred to Hicks, a child was saved by the introduction of a finger: the air suddenly rushed in, and the child was then enabled to breathe. But a child may be born in this state when no person is at hand to assist the woman: in this case it will die; and the lungs being found in the fœtal or unexpanded condition, it will be pronounced still-born. Obstruction of the air-passages is a frequent cause of death among new-born children.

The varieties of *malformation* are very numerous, but there can be no difficulty in determining whether they are such as to account for death. Persons are not allowed to destroy monstrous births; and the presence of any marks of violence in such cases should be regarded with suspicion. It is the more necessary to make this statement, as there is an idea among the vulgar that it is not illegal to destroy a monstrous birth. A lady was delivered of a most hideous dicephalous (two-headed) monster. In his absence, and at the earnest solicitations of the friends, the nurse destroyed it. The question was—Was this woman guilty of murder? The only case in reference to this point, which is recorded by medico-legal writers, is that of two women who were tried at the York Assizes in 1812, for drowning a child which was born with some malformation of the head, in consequence of which it was not likely that it could survive many hours. It did not appear that there had been any malice or concealment on the part of the prisoners, who were not aware of the illegality of the act. (Paris and Fonblanque, 'Med. Jur.,' vol. i. p. 228.) The absence of malicious intention would probably lead to an acquittal on a charge of murder; but such an act would doubtless amount to manslaughter, as the degree of monstrosity or the viability of the offspring cannot be received as an extenuating circumstance. As to the first, if a liberty of judging of what was monstrous and what not were conceded to any ignorant nurse, children simply deformed might be put to death on this pretence; as to the second, it is held in law that whoever accelerates death causes it; hence the fact that a child is not likely to live more than a few hours does not justify the act of one who prematurely destroys it.

6. *Spasms of the Larynx.*—Some children are born alive, and on coming into the world make attempts to breathe, but, owing to spasms of the larynx and retraction of the tongue, the air is unable to enter; the child dies soon after birth, and on inspection, no air being found in the lungs, the child is wrongly pronounced to have been born dead. ('Guy's Hosp. Rep.,' 1866, p. 476.) A careful examination of the fauces may show the presence of mucus or meconium, or a condition of the epiglottis which may account for the obstruction to respiration. Hicks has on more than one occasion seen the new-born child make these inspiratory efforts, and by lifting the epiglottis has given free passage to the air, and the child has been saved.

7. *Atelectasis.*—Atelectasis, as it has been elsewhere explained (*ante,* p. 573), implies simply an unexpanded state of the lungs. In some cases it is complete, in others partial. It can scarcely be regarded as a diseased condition, as the body of a child may be otherwise healthy; the lungs themselves are in a normal state, and they can be easily expanded by the artificial introduction of air, or by other remedial measures when assistance is at hand. This imperfect expansion of the lungs is generally due to debility in the child, and it is especially a cause of death in weakly or immature children. But strong and healthy children may die from simple non-inflation of the lungs.

Assuming that *in utero* the child lives by what has been called 'placental respiration,' *i.e.* a continuous supply of sufficiently oxygenated blood from the woman, another explanation may be offered. If anything should arrest the placental circulation during labour by interrupting the flow of blood to the child through the umbilical cord, this may cause its death before pulmonary inspiration can be established. The child is born asphyxiated, and this may explain the state of atelectasis. Every contraction of the womb more or less interrupts placental respiration as it is above defined. The child lives inside the womb by the placenta, and outside by the lungs. If the action of the placenta is destroyed before that of the lungs can be set up, this would explain the condition known under the name of *atelectasis.* (See a paper by Hofmann, 'Vierteljahrsschr. für Gerichtl. Med.,' 1873, 1, p. 219.)

8. *Congenital Disease.*—It has been elsewhere stated (p. 573, *ante*) that a child may be born labouring under such a degree of congenital disease as to render it incapable of living. The discovery of any of the fœtal organs merely in a morbid condition amounts to nothing unless the disease has advanced to a degree which would be sufficient to account for death. There are, doubtless, many obscure affections, particularly of the brain, which are liable to destroy the life of a child without leaving any well-marked changes in the dead body. According to Burgess, apoplexy and asphyxia are common causes of death among new-born children. ('Lond. Med. Gaz.,' vol. xxvi. p. 492; Henke's 'Zeitschrift der S. A.,' 1843, p. 67.) Probably diseases of the lungs are of the greatest importance in a medico-legal point of view; because, by directly affecting the lungs, they render it impossible for a child to live, or to survive its birth for a long period. These diseases in the fœtal state are principally congestion, hepatization, tubercle, scirrhus, œdema, the existence of any of which it is not difficult to discover. They render the structure of the lungs heavier than water, and thus prevent the organs from acquiring that buoyancy which in their healthier state they are known to possess. It is not common to find the lungs diseased throughout—a portion may be sufficiently healthy to allow of a partial performance of respiration.

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That a large number of illegitimate children, especially when immature, are born dead from *natural* causes.

2. That a child may die from exhaustion as the result of a protracted labour.

3. That if a child be prematurely born, or if it be small and weak even at the natural period, it may die from mere debility or want of power either to commence or to continue the act of breathing.

4. A child may die from loss of blood, owing to accidental rupture of the cord during delivery; and may even die from this cause after it has breathed.

5. That fatal bleeding is more likely to occur when the cord has been cut close to the abdomen than when it has been lacerated or cut at a distance from the navel.

6. That the division of the cord, whether by rupture or incision, without ligature, is by no means necessarily fatal to a healthy mature child.

7. That a child may die from accidental compression of the cord during delivery, the circulation between the mother and the child being thereby arrested before respiration has commenced.

8. That death may speedily follow birth from some malformation or defect, or from a defective condition of organs important to life.

9. That a child may die from congenital disease affecting the organs of respiration or the air-passages.

CHAPTER 53.

VIOLENT CAUSES OF DEATH.—SUFFOCATION.—DROWNING.—DEATH OF THE CHILD FROM COLD AND EXPOSURE.—STARVATION.—DEATH FROM IMMATURITY.—WOUNDS IN NEW-BORN CHILDREN.—FRACTURES ON THE SKULL, ACCIDENTAL AND CRIMINAL.—TWISTING OF THE NECK.—VIOLENCE IN SELF-DELIVERY.—POWER OF LOCOMOTION AND EXERTION IN FEMALES AFTER DELIVERY.

Violent Causes of Death.—In this chapter we have to consider those modes of death which are totally independent of the existence of congenital disease or other natural causes. In most cases of alleged child-murder, the body of the child bears about it the marks of physical injury, such as those which are indicative of strangulation, wounds, burns, and fractures. The marks of violence may be such as to leave no doubt that they were wilfully inflicted. In order to render either the woman or a confederate criminally responsible, it must be distinctly proved that the injuries were unlawfully inflicted on a *legally* living child, and that they were the cause of death. If the child has died after birth, from violence carelessly or ignorantly inflicted during birth or afterwards, or from culpable negligence, this will constitute a case of manslaughter. A question of medical responsibility may be raised under these circumstances, as where a medical man is charged with having caused the death of a child by gross ignorance and carelessness in the delivery of a woman. The following instance is reported. (Chitty's 'Med. Jur.,' p. 416; also Archbold, p. 345.) A man named *Senior*, an unlicensed medical practitioner, was tried for the manslaughter of an infant by injuries inflicted on it at its birth. The prisoner practised midwifery, and was called to attend the prosecutrix, who was taken in labour. The evidence showed that when the head of the child presented, the prisoner, by some mismanagement, fractured and otherwise so injured the cranium, that the child died immediately *after* it was born. It was argued, in defence, that as the child was not born, but *in ventre sa mère,* at the time the wounds and injuries were inflicted, the prisoner could not be guilty of manslaughter. The judge, however, held that as the child was born *alive* and had subsequently died from the violence, the case might be one of manslaughter. This opinion was afterwards confirmed by the other judges, and the prisoner was convicted and sentenced to imprisonment. From the decision in this case, it will be seen that, if the prisoner had effectually destroyed the child before it was entirely born, he would not have been guilty of any crime.

Some of the causes of death in new-born children are unavoidable, others may be avoided by care and ordinary precautions. In some cases where the death of the child after its birth had been traced to culpable negligence on the part of the woman, judges have directed a verdict of manslaughter, and have inflicted a severe punishment—ten years' penal servitude. (*Reg.* v. *Maynard,* Devon Aut. Ass., 1871; *Reg.* v. *Libbey,* Cornwall Aut. Ass., 1871; and *Reg.* v. *Sell,* Hereford Lent Ass., 1873.) In no case, however, have they dispensed with the proof that the child was *born* alive, either from medical or other evidence, or from the confession of the woman.

Some general observations have been elsewhere made on the mode in which the dead body of a child in an alleged case of child-murder should be examined (*ante,* p. 562). A note of all marks of physical injury, however slight in appearance, may be of importance in the case. There are some forms of child-murder which are not necessarily attended with marks of violence; thus a child may be criminally destroyed by suffocation, drowning, exposure to cold, or privation of food. It may die under these circumstances, and its body may present no unusual appearance. These modes of destroying life will therefore first require consideration.

1. *Suffocation.*—This is a common cause of death in new-born children. A wet cloth may be placed over the child's mouth, or thrust into the cavity, either during birth or afterwards, and before or after the performance of respiration. To the latter case only could the term 'suffocation' be strictly applied. In *Reg.* v. *Eley* (C. C. C., Aug. 1878), a case of alleged manslaughter, the child was found dead with a pocket-handkerchief forcibly stuffed into its mouth. The state of the lungs showed that it had breathed, but it had not been heard to cry. According to the medical evidence, the child had died from suffocation. The defence was that there was no proof that it had been born alive. Notwithstanding the plain evidence as to the mode of death, the

jury acquitted the prisoner. A child may be destroyed by being allowed to remain closely compressed under the bed-clothes after delivery, or by its head being thrust into straw, feathers, ashes, and similar substances. Under these circumstances, the child is not suffocated, but dies from the prevention of breathing. The appearances in the body in such cases are seldom sufficient to excite a suspicion of the cause of death, unless undue violence has been employed. There is commonly merely lividity about the head and face, with slight congestion of the lungs. A careful examination of the mouth and throat should be made, as foreign substances are sometimes found in this situation, affording circumstantial evidence of the mode in which the suffocation has taken place. Thus wood, straw, feathers, ashes, tow, or a hard plug of linen have been found blocking up the mouth and throat, drawn into these parts by aspiration when the mouth of a child has been covered with such substances. When a child is found dead under these circumstances, a question will arise whether the ashes, dust, or other substances found in the air-passages have either been wilfully thrust into the mouth and throat, or accidentally drawn in by aspiration. Whether an accused person has placed the ashes in the mouth or buried the face of a child in them so that they might be thus drawn in, can make no difference in the nature of the crime. If the ashes are in large quantity, of large size, firmly impacted, and the lining membrane of the mouth presents signs of laceration or bruising, there can be no doubt that violence has been used. Aspiration would not explain facts of this kind. Again, the cinders and other substances may be found in the windpipe and bronchi, into which parts they could not have been forced by manual violence. In all these cases the mouth and fauces require careful examination.

If a child has lived sufficiently long to be fed, it may be accidentally suffocated by the entrance of portions of solid food, such as the curd of milk, into the windpipe and air-passages. A new-born child may be suffocated by having its head held over noxious vapours, such as the exhalations of a privy or of burning sulphur; and it is here necessary to remind a medical jurist that other highly poisonous vapours, *e.g.* chloroform, or coal-gas (the agent used for the destruction of stray dogs in Paris), may be used by a criminal without leaving any indication in the body—except, possibly for a short time, that which may depend upon their peculiar odour. There are few of these cases of suffocation in which a positive medical opinion of the cause of death could be given, unless some circumstantial evidence were produced, and the witness were allowed to say whether the alleged facts were or were not sufficient to account for death. ('Ann. d'Hyg.,' 1832, t. 1, p. 691.)

On the other hand, if it be even clearly proved that death has been caused by suffocation, it must be remembered that a child may be accidentally suffocated, and the crime of murder falsely imputed. Duncan, quoting the observations of Buhl, states that obstruction of the air-passages by mucus and other matters is a frequent cause of death in new-born children. Among twenty-seven children dying during birth, or shortly after, eleven died from obstruction of the air-passages with foreign matters. Eight were born dead, and of those which were alive at birth, not one survived the first day. In ten of the cases the obstruction was produced by a greenish or greenish-brown or slimy mass (meconium and mucus) filling the larynx and windpipe. In two of the cases, in which the child died during delivery, air was found in the lungs, and in only one of these the air had been derived from the act of breathing during birth. ('Edin. Month. Med. Jour.,' April, 1863, p. 924; also 'Med. Times and Gaz.,' 1861, ii. p. 117.) In Hicks's case (p. 600, *ante*), the base of the tongue in a new-born child was so drawn down by spasmodic action as to close the glottis by pressing backwards the epiglottis. The child was saved by simply raising the epiglottis, when air rushed in and breathing was established; but many children may be born under similar conditions when no assistance is at hand. Cases of this kind, however, rarely give rise to charges of child-murder, as no air is found in the lungs. A child might be killed during delivery, by pressure applied to the chest; this might be such as not to produce any mark of violence. If the child had not breathed, there would be nothing to indicate the mode of death; if air had entered the lungs, then the usual appearances will be found in these organs (p. 568). In dealing with a case of this kind, it should be remembered that a child with its head born, but detained in the outlet by the size of its shoulders, might die from pressure exerted on the chest by the vagina. It might have breathed, but be born dead, with the marks of suffocation about it.

There is another accidental cause of the death of a new-born child during delivery. The membranes or caul may be carried forward over the head and face, and the act of breathing thus mechanically prevented. If no assistance is at hand, the child, though born living, will die soon after birth in consequence of the prevention of respiration. If, when the dead body is found, the membranes are no longer there, the cause of the prevention of respiration would not be apparent. The child, although born living, would probably be pronounced to have been born dead. ('Med. Times and Gaz.,' 1863, i. p. 126.) The delivery of a child with a mask or caul around its head is not an unfrequent occurrence. In 1862, Blenkinsop communicated to the author a case in which a mature and healthy child so born was allowed to perish by those who had access to it. The caul was simply not removed, so that breathing could not be set up. The lungs contained no air. There was congestion of the brain and lividity of the body, but no mark of violence. There was some evidence that the child had been born living, and that the cause of death was the prevention of respiration by omission to do that which was necessary; but as the medical evidence showed that the child had not breathed, the coroner held that it had never had any (legal) existence, and that there was no ground for further investigation. W. Hunter, who was well aware of the risk to which a woman might be thus exposed, observes in relation to this state of things: 'When a woman is delivered by herself, a strong child may be born perfectly alive, and die in a very few minutes for want of breath, either by being on its face in a pool formed by the natural discharges, or upon wet clothes; or by the wet things over it collapsing and excluding air, or being drawn close to its mouth and nose by the suction of breathing. An unhappy woman delivered by herself, distracted in her mind and exhausted in her body, will not have strength or recollection enough to fly instantly to the relief of her child.' It may be added that a primiparous woman may faint or be wholly unconscious of her situation; or, if conscious, she may be ignorant of the necessity of removing the child, and thus it may be suffocated without her having been intentionally accessory to its death. In such cases, however, there should be no marks of violence on the body, or, if present, they should be of such a nature and in such a situation as to be readily explicable on the supposition of an accidental origin. (See 'Vierteljahrsschr. für Gerichtl. Med.,' 1864, 2, p. 123.)

An infant is easily destroyed by suffocation. It is a frequent form of infanticide. Tardieu stated that he had had the cases of 132 new-born children to examine, and in 72 of them he detected clear evidence of death by suffocation. ('Ann. d'Hyg.,' 1855, t. 2, p. 372.) If the mouth and nostrils of a child are kept covered for a few minutes, by the face being closely wrapped in clothes, asphyxia may come on without this being indicated by convulsions or any other marked symptoms (see p. 454, *ante*). A suspicion of murder may arise in such cases; but the absence of marks of violence, with an explanation of the circumstances, will rarely allow the case to be carried beyond an inquest. Sometimes the body is found maltreated, with severe fractures or contusions on the skull, and marks of strangulation on the neck; concealed in a feather-bed or privy, or cut up and burnt. This kind of violence may properly excite a suspicion of murder, and lead to the belief that the allegation of death from accidental suffocation is a mere pretence. This, however, is purely a question for a jury, and not for a medical witness. Unless the case is of a glaring nature, the violence is considered to have been employed for the purpose rather of concealing the birth of a child than of destroying it. In the present day, these cases of death from accidental suffocation, when properly investigated, can never involve an innocent woman in a charge of murder, although the facts may show in many instances that the death of the child was really due to great imprudence, gross neglect, or culpable indifference on her part. When culpable neglect or reckless indifference to the life of a new-born child has been proved against a woman charged with murder, a verdict of manslaughter is usually returned.

The appearances in the body in cases of death from suffocation have been elsewhere described, in reference to adults (p. 447); they are similar in new-born children, provided respiration has been fully performed. Tardieu attaches great importance to the discovery of subpleural ecchymoses in the lungs of children: he has also noticed small effusions of blood on the surface and in the substance of the thymus gland. ('Ann. d'Hyg.,' 1855, t. 2, p. 379.) If the lungs float on water, as the result of breathing, then the appearances described will be met with; but it is worthy of remark that in three instances Tardieu met with similar appearances in children whose lungs had not received air, and sank when placed on water. There is no doubt that these ecchymoses are very valuable signs of suffocation. Douillard and Gallard have, however, met with them in death from natural causes. ('Ann. d'Hyg.,' 1872, t. 1, p. 201.) They were children prematurely born, and under conditions which prevented full vital development. One uttered several cries, but in spite of this, the lungs contained no air. The subpleural ecchymoses met with in children under these circumstances are ascribed by Tardieu to the efforts made to breathe after birth. Partial emphysema of the lungs is occasionally observed. Ssabinski is of opinion that a bloodless condition of the spleen is a more serviceable sign of suffocation. ('Vierteljahrsschr. für Gerichtl. Med.,' 1867, vol. 2, p. 146.)

Some remarks have been elsewhere made on the evidence derivable from the presence of subpleural ecchymoses (p. 448). In death from suffocation they are not always found, and in other forms of asphyxia they have been occasionally seen, so that they cannot be considered as characteristic of any one form. In 1872, a servant-girl had given birth to a healthy child. This child was found alive, about a quarter of an hour afterwards, in a privy, and it lived a few minutes after the discovery. Its jaw was broken, its cheek torn, and the mouth contained ashes, some of which were found in the back part of the throat. The body was blanched, and there had evidently been a great loss of blood from the wounds and the torn navel-string. There was no engorgement of the lungs, nor were there any subpleural ecchymoses. The lining membrane of the windpipe was stained with ashes, and a small cinder was found in the left bronchus. In this case there was no question respecting live birth, as the child was living when found; but what was the cause of death? and was this accidental or the result of violence wilfully applied after birth? In the opinion of Moore, the mouth of the child had been forcibly torn open and filled with ashes in order to suffocate it; these ashes might have been then drawn by aspiration into the air-passages, and death caused partly by suffocation and partly by hæmorrhage from the wounds, the child's body being bloodless. The condition of the lungs was not inconsistent with death from suffocation. (For some remarks on death from suffocation in child-murder, with reports of cases, see a paper by Séverin Caussé, 'Ann. d'Hyg.,' 1869, t. 2, pp. 122, 443.)

2. *Drowning.*—The fact of drowning cannot be verified by any appearances on the body of a child which has *not* breathed. Thus, if a woman caused herself to be delivered in a bath, and the child was forcibly retained under water (a case which is said to have occurred), it would of course die; but no evidence of the mode of death would be found in the body. After respiration, the signs of drowning will be the same as those met with in the adult (see p. 389, *ante*). The main question for a witness to decide will be whether the child was

put into the water living or dead. Infanticide by drowning is by no means common; the child is generally suffocated, strangled, or destroyed in other ways, and its body is then thrown into water in order to conceal the real manner of its death. The fact of the dead body of an infant being found in water must not allow a witness to be thrown off his guard; although a verdict of 'found drowned' is commonly returned in these cases, the body should be carefully inspected in order to determine what was really the cause of death. All marks of violence on the bodies of children that have died by drowning should be such as to have resulted from accidental causes. The throat and air-passages should be particularly examined. It is not necessary that the *whole* of the body of a child should be submerged, in order that it may be destroyed by drowning; the mere immersion of the head in water or the covering of the mouth by liquid will suffice to produce the usual effects of asphyxia.

The outlets of the ears and the air-passages should be examined for foreign substances which may be deposited in them. New-born children may be drowned or suffocated by being thrown into mud or into the soil of a privy. Sometimes the child is destroyed by other means, and its body is thus disposed of for the purpose of concealment. Should there be a large quantity of liquid present, the phenomena are those of drowning. The liquid portion of the soil, abounding in sulphide of ammonium, may be found, if the child was thrown in living, in the air-passages, gullet, or stomach. The mere discovery of soil in the mouth would not suffice to show that the child was living when immersed; but the presence of foreign substances, such as dirt, straw, or ashes, in the air-passages, gullet, and stomach, has usually been taken as a medical proof that the child was living when immersed, and that the solid substances had been drawn into the passages by aspiration or by the act of swallowing,

On these occasions the defence may be: 1. That the child was born dead and that the body was thrown in for concealment; but the medical evidence may show that it had breathed, and had probably been born living. 2. It may be alleged that the child breathed for a few moments after birth, had then died, and that the woman had attempted to conceal the dead body. A medical witness may be here asked whether a woman could have had power to convey the body to the place—a point which must, as a general rule, be conceded. 3. It is commonly urged that the woman, being compelled to go to the privy, was there *delivered unconsciously* or unexpectedly; that her waters had broken, and that she had no idea of anything more having happened; or that the child had dropped from her, and was either suffocated or prevented from breathing. ('Med. Times and Gaz.,' 1861, ii. p. 646.) All these circumstances may readily occur; but, on the other hand, such statements may be inconsistent with some of the medical facts. (See a case, 'Ann. d'Hyg.,' 1855, t. 2, p. 453; also Casper's 'Klin. Novel.,' 1863, p. 585.) Thus the head or the limbs of a child may be found to have been separated or divided by some cutting instrument, or a cord or other ligature may be found tightly bound around its neck, or there may be a tightly fitting plug in the throat. Then, again, the body may be entire, but the navel-string may be *cleanly cut.* This would tend to set aside the explanation of the child having accidentally dropped from the female; because in such an accident the cord should always be found *ruptured.* The practitioner should make a careful examination of the divided ends of the cord by the aid of a lens, or a rupture may be mistaken for a section with a sharp instrument. Higginson published a case of some interest in this point of view. The child fell from the mother, and the cord broke spontaneously. 'The torn ends were,' he states, 'nearly as sharp-edged and flat as if cut.' ('Lond. Med. Gaz.,' vol. xlviii. p. 985.) This case goes to prove that a careless or hasty examination of the ends of the cord may lead to a serious mistake. When the cord is lacerated, this will be, *cæteris paribus*, in favour of the woman's statement as to the mode in which her delivery occurred.

Drowning may be the result of accident from sudden delivery. A woman in an advanced state of pregnancy, while sitting on a chamber-vessel, was suddenly delivered. The child fell into the fluids in the vessel, and before assistance could be rendered, it was dead. Whether, in any instance, the *drowning* of a child was accidental or criminal, must be a question for a jury to determine from all the facts laid before them. The situation in which the body of an infant is found may be consistent with the supposition of accident. Thus a child may be accidentally drowned by its mouth falling into a pool of the discharges during delivery, although this would be rather a case of suffocation. The throat, windpipe, and stomach of the child should always be examined on these occasions, as mud, sticks, straw, weeds, or other substances may be found in these parts, indicating, according to circumstances, that the child had been put into the water living, and that it had been drowned in a particular pond or vessel.

3. *Cold and Exposure.*—A new-born child may be easily destroyed by simply exposing it uncovered, or but slightly covered, to a cold atmosphere. In a case of this kind there may be no marks of violence on the body, or these may be slight and evidently of accidental origin. In death from cold, the only appearance occasionally met with has been congestion of the brain, with or without serous effusions in the ventricles. (See Cold, p. 496, *ante.*) The evidence in these cases must be purely circumstantial. The medical witness may have to consider how far the situation in which the body was found, the kind of exposure, and the temperature of the air, would suffice to account for death from the alleged cause. There is no doubt that a new-born child may soon perish from exposure to a low temperature, and that warm clothing is required for the preservation of its life. An inspection of the body should never be omitted on these occasions, because it might turn out that there was some latent cause of natural death which would at once do away with the charge of murder. Admitting that the child had died from cold, it becomes necessary to inquire whether it was exposed with a malicious intention that it should thus perish. Unless wilful malice be made out, the accused cannot be convicted of

murder, and unless culpable neglect is proved, she cannot be convicted of manslaughter. In general, women do not expose their children for the purpose of destroying them, but for the purpose of abandoning them; hence it is rare to hear of convictions for child-murder where cold was the cause of death, although some medical jurists have called this infanticide by *omission*.

4. *Starvation*.—A new-born child kept long without food will die, and no evidence of the fact may be derivable from an examination of the body. There may be no marks of violence externally, nor any pathological changes internally, to account for death. This is a rare form of murder, except as it may be accidentally combined with exposure to cold. In order to convict the mother, it is necessary to show that the child was wilfully kept without food, with the criminal design of destroying it. Mere neglect or imprudence will not make the case infanticide. The only appearance likely to be found on an examination of the body would be complete emptiness of the alimentary canal. Without corroborative circumstantial evidence, this would not suffice to establish the cause of death; and a medical witness could only form a probable conjecture on the point. In a suspected case of this kind, the contents of the stomach should be tested for farinaceous and other kinds of food.

5. *Immaturity in Cases of Abortion*.—From the case of *Reg.* v. *West* (Nottingham Lent Ass., 1848), it would appear that if, by the perpetration of abortion or the criminal induction of premature labour, a child be born living at so early a period of uterine life that it dies merely from *immaturity*, the person causing the abortion, or leading to the premature birth, may be tried on a charge of murder. A midwife was alleged to have perpetrated abortion on a female who was between the fifth and sixth months of pregnancy. The child was born living, but died five hours after its birth. There was no violence offered to it; and its death appeared to be due entirely to its immaturity. The prisoner was acquitted, apparently on the ground that abortion might have arisen from other causes. In a case of this kind it must be clearly proved that the child survived its birth.

Among those causes of *violent* death which leave on the body of the child marks or appearances indicative of the cause, may be mentioned wounds, strangulation, and poisoning.

6. *Wounds*.—This is a frequent cause of death in cases of child-murder. Wounds may, however, be found on the body of a child which has died from some other cause. The principal questions which a medical witness has to answer are (1) whether the wounds were inflicted on the body of the child before or after death; (2) whether they were sufficient to account for death; and (3) whether they resulted from accident or criminal design. The child may have been destroyed by *burning*, and evidence must then be sought for by an examination of the state of the skin. All these questions have been fully considered in treating the subject of Wounds and Burns, and they therefore do not require any special notice in this place. Incised

wounds found on the bodies of new-born children may be referred to the use of a knife or scissors by the prisoner, in attempting to sever the navel-string, and they may, therefore, be due to accident. This point should not be forgotten, for a wound even of a severe kind might be thus accidentally inflicted. In such cases we should always expect to find the navel-string *cut*, and not lacerated. The end of it may, for the purpose of examination, be stretched out on a white card. This will in general suffice to show whether it has been cut or torn. Wounds, however slight, should not be overlooked; minute punctures or incisions externally may correspond to deep-seated injury of vital organs. The spinal marrow is said to have been wounded by needles or stilettoes introduced between the vertebræ, the skin having been drawn down before the wound was inflicted, in order to give to it a valvular character, and to render it apparently superficial. The brain is also said to have been wounded, by similar weapons, either through the nose or the thinner parts of the skull (the fontanelles). Hence, in examining the head of a new-born child to determine the cause of death, it is always necessary to observe the state of the fontanelles. Children have been destroyed by small punctures made through these membranous coverings. Fatal wounds of the brain have been thereby produced. ('Ann. d'Hyg.,' 1878, t. 2, p. 498.)

In some instances the body of a child is found cut to pieces, and the allegation in defence may be that the child was still-born, and the body thus treated merely for the purpose of concealment. Toulmouche has reported a case of this kind, which was the subject of a trial. As the woman had not destroyed the lungs, experiments on these organs gave satisfactory results of complete respiration. The cavities of the heart and great vessels were empty; the body was generally drained of blood, and the skin throughout very pale. This led to the inference that the mutilations must have been inflicted while the child was living; and as all the parts were healthy, and no natural cause of death was apparent, Toulmouche ascribed the death of the child to the wounds. The woman was convicted. ('Ann. d'Hyg.,' 1853, t. 2, p. 200.) In this country, she would probably have escaped under a verdict of 'concealment of birth.'

Injuries to the Head.—It has been elsewhere stated that, during a protracted delivery, there is formed on the head of a child a tumour containing either serum, blood, or a mixture of the two. If a woman has been secretly delivered, non-professional persons may ascribe a tumour of this kind to violence, whereas it may really have been produced by natural causes. The tumour is generally situated on one of the parietal bones, its situation depending on that part of the head which presents during delivery. After the discharge of the waters, the scalp is firmly compressed by the mouth of the womb, and subsequently by the os externum. This pressure interferes with the circulation through the skin, and causes the compressed portion of the scalp to swell. In the simplest form of this tumour, serum only is found in the swollen part: occasionally this is mixed with blood, and there are small ecchymoses of the scalp, as well as of the pericranium and skull, but there is generally no injury to the bones, nor is there any laceration of the skin externally. In other cases blood is found effused in the tumour either under the scalp, the membrane covering the skull (pericranium), or within the skull itself. The term *Cephalæmatoma*, or *Caput succedaneum*, is applied to a tumour which has this natural origin (p. 597, *ante*). The sanguineous is more likely to be confounded with the effects of violence than the serous tumour; but it may be identified by the scalp being always uninjured, although it may present redness and lividity. Violence from blows or falls which would produce effusions of blood beneath the scalp, or within the skull, would in general be indicated by injury to the skin or by fracture of the bones.

The only injuries to the head which require to be specially considered in relation to infanticide are *fractures of the skull*; and here the question to which we may chiefly confine our attention is whether the fracture arose from accident or criminal violence. The rules for determining whether these injuries were inflicted during life or after death have been elsewhere considered. (See Wounds, pp. 234, 364.) Although it has been a matter of frequent observation that great violence may be done to the head of a child during parturition without necessarily giving rise to fracture, yet it is placed beyond all doubt that such an injury may occur by the expulsive efforts of the womb in forcing the head of a child against the bones of the pelvis. Even the violent compression which the head sometimes experiences in passing the mouth of the womb may suffice for the production of fracture. (See 'Edin. Med. and Surg. Jour.,' vol. xxvi. p. 75.)

It was formerly supposed that fractures of the skull in new-born children were always indicative of criminal violence; but cases which have occurred in obstetric practice have established the certainty of their accidental occurrence. These accidental fractures, it is to be observed, are generally slight; they commonly amount merely to fissures in the bones, beginning at the sutures and extending downwards for about an inch or less into the body of the bone. According to Weber, the frontal and parietal bones are the only bones liable to be fissured or fractured by the action of the womb during delivery; and in the greater number of cases reported, the parietal bones only have presented marks of fracture. The possible occurrence of an injury of this kind as the result of uterine action has been strained, in several cases of child-murder, to explain the origin of fractures which could not fairly or reasonably be assigned to such an accident. A case was tried at Glasgow, in April, 1852 (case of *Ann Irvin*), in which there was no doubt, from the state of the lungs, that the child had fully breathed, and there was violence to the head which satisfactorily accounted for its death. The whole of the right side of the head was deeply ecchymosed, and there was a large quantity of coagulated blood lying beneath the scalp. In the centre of the right parietal bone there was a fracture extending across the vertex for fully four inches, and involving a part of the parietal bone on the opposite side; it was in a continuous even line, not radiated and not depressed. The pericranium, bones, and soft parts in the track of the fracture were deeply ecchymosed, while on the surface of the brain, particularly on the right side, there was a copious effusion of clotted blood. It was impossible to refer severe injuries of this kind to the action of the womb in delivery, or to violence applied after death. The prisoner alleged that the child was still-born.

Accidental fractures and effusions of blood which are caused by uterine action may be in general recognized by their slight extent. In cases of murder by violence to the head, the injuries are commonly much more severe: the bones are driven in, the brain protrudes, and the scalp is extensively lacerated. Such severe injuries as these cannot be ascribed to the action of the womb in parturition. Here, however, it may be fairly urged that the woman was unexpectedly seized with labour, that the child was expelled suddenly by the violent efforts of the womb, and that the injuries might have arisen from its head coming in contact with some hard surface—as a floor or pavement. It must be admitted that a woman may be thus suddenly and unexpectedly delivered while in the erect posture, although this is not common among primiparous women; and that injuries may be thus accidentally produced on the head of a child.

A woman is often unable to distinguish the sense of fulness, produced by the descent of a child, from the feeling which leads her to suppose that she is about to have a stool; and thus it is dangerous, when a labour has advanced, to allow a woman to yield to this feeling, for there is nothing more probable than that the child will be suddenly born. Rankin reported two cases of this description, where there could not be the slightest suspicion of criminality. In one, a primipara, the child was actually born under these circumstances, but its life was fortunately saved: had there been no other convenience than a privy, it must have been inevitably lost. In the second, although a case of third pregnancy, the female was equally deceived by her sensations. ('Edin. Month. Jour.,' Jan. 1846, p. 11.) It is true that this alleged mistaken sensation forms a frequent and specious defence on charges of child-murder; but still, a medical jurist is bound to admit that this accident may occur to women without necessarily implying guilt.

The following case shows that a fracture of the skull of a child may occur when a woman is delivered in the erect posture. In this instance there was merely the appearance of a bruise on the head, and the navel-string was ruptured (not cut) three inches from the navel. The child did not suffer from the fall, and continued well until six days after its birth, when it was seized with convulsions and died. A fissure of about an inch and a half in length was found in the upper part of the left parietal bone. A clot of blood was found in this situation between the dura mater and bone, and there was congestion of the vessels of the membranes; but with this exception, there was no morbid appearance in the body. ('Assoc. Jour.,' Oct. 14, 1853, p. 901.) Porter Smith communicated to the author a case in which the facts were similar to those above related. In consequence of the concealment of the body, however, the mother was charged with murder. The right parietal bone was fractured, and there was effusion of blood internally, but there was no mark of external violence. The cord had been ruptured at a distance of two inches and a half from the navel. The stomach of the child contained the usual albuminous and mucous matters of the fœtal state, without any appearance of food. The lungs contained air, and were highly crepitant; the foramen ovale and the ductus arteriosus were in their fœtal condition. The child had probably been drowned in the discharges from want of assistance at the time of birth. The woman, who admitted that the child had fallen from her suddenly, was acquitted. Olshausen published four cases of sudden delivery, in each of which the child dropped from the woman, and in two of them there were fissures in the parietal bones. The children recovered from the effects of the accidents. ('Med. Times and Gaz.,' 1860, ii. p. 219; 'Amer. Jour. Med. Sci.,' 1861, p. 279.) Other cases of rapid delivery in the erect posture are reported in the 'Lancet' (1861, i. p. 13). In these there was no injury to the child, although in one case the delivery took place on the deck of a vessel.

A medical witness would find no difficulty in determining the probability of this explanation of the accidental origin of such fractures, if he were made acquainted with all the facts connected with the delivery. But the acquisition of this knowledge must be accidental; and it will in general be out of his power to obtain it. When the fractures are accompanied by cuts, punctures, or lacerations of the scalp or face, although their production might be accounted for by an alleged fall during parturition, the cause of these wounds would still remain to be explained. In fractures of the bones of the head in new-born children, the presence of effusions of blood on the outside of the skull, or on the membranes within, is one of the most common appearances. Effusions of blood beneath the skin of the scalp are by no means uncommon in new-born children, and are not necessarily indicative of criminal violence. Each case, however, must be decided by the circumstances attending it. Effusions on the membranes and in the substance of the brain are generally the result of great violence to the head. (See Tardieu, 'L'Enfanticide,' p. 133.)

Twisting of the Neck.—Children are sometimes destroyed in the act of birth by the neck being forcibly twisted, whereby a displacement of the vertebræ of the neck, with injury to the spinal marrow, may occur, and destroy life. Such injuries are immediately discovered by an examination of the body. It should be remembered that the neck of a child is very short, and that it always possesses considerable mobility.

Destruction by Fire.—New-born children are sometimes destroyed by placing their bodies in a fierce fire. The result of this is that only charred flesh with white fragments of burnt bones may be found. In one case, elsewhere reported, the body of a child was found in a saucepan, boiled. It was here a question whether it had been put in living or dead (see p. 381).

Violence in Self-delivery.—When the marks of violence found on the head, neck, or body of a child cannot be easily referred to uterine action or to an accidental fall, it is common to ascribe them to the efforts made by a woman in her attempts to deliver herself—the destruction of the child being an accidental result of these efforts. A medical opinion in such cases must depend upon the nature, situation, and extent of the injuries; and each case must be therefore decided by the circumstances attending it. A medical witness, however, should always be prepared to allow that a woman at the time of her delivery, owing to pain and anxiety, may be deprived of judgment, and may destroy her offspring without being conscious of what she is doing. It is, therefore, a sound principle of law that mere appearances of violence on a child's body are not *per se* sufficient, unless there is some evidence to show that the violence was knowingly and intentionally inflicted, or the appearances are of such a kind as of themselves to indicate intentional homicide.

Power of Exertion in recently Delivered Women.—On these occasions, a witness will often find himself questioned respecting the strength or capability for exertion evinced by the lower class of women shortly after child-birth. Alison remarks that many respectable medical practitioners, judging only from what they have observed among the higher ranks, are liable to be led into an erroneous opinion, which may affect their evidence. He mentions a case in which a woman accused of child-murder walked a distance of twenty-eight miles in a single day, with her child on her back, two or three days after her delivery. (Case of *Anderson*, Aberdeen Spring Circ., 1829.) Instances have even occurred in which women have walked six and eight miles, on the very day of their delivery, without sensible inconvenience. In one case (*Smith*, Ayr Spring Circ., 1824), the woman was engaged in reaping; she retired to a little distance, effected her delivery by herself, and went on with her work for the remainder of the day, appearing only a little thinner and paler than usual. In *Reg.* v. *Stowler* (Wells Aut. Ass., 1865), two witnesses proved that the prisoner, who was tried for the murder of her child, was at work with them in a field about 800 yards from a pond in which the body was afterwards found. They left the prisoner weeding, returned in about an hour, and she was not then in the field. After a time she returned, sat on a bank, and then resumed her work. The witnesses noticed that, on her return, there was a great difference in her appearance. In this short interval she had been delivered, had disposed of the body of the child, and resumed her work, as if nothing had happened. A firm resolution, with a desire to conceal her shame, may enable a woman, immediately after her delivery, to perform acts connected with the disposal of the body of her child which, from ordinary experience, might appear to be far beyond her strength.

In *Reg.* v. *May* (Exch. Ct., May, 1857), for concealment of birth, it was proved that the prisoner, a domestic servant, had been sent to market with some poultry. On her return, she asked the boy who drove the cart to stop. He did so; she got out, went to a recess in the hedge by the side of the road, in five minutes was observed following the cart, and walked home, a distance of a mile and a half. She went about her usual work on that and the following day. The woman had been delivered of a child in the recess, and it was subsequently found there. One witness heard it cry, but it soon died.

Conclusions.—The conclusions to be derived from the contents of this chapter are—

1. That a new-born child may die from violent causes of an accidental nature.
2. That some forms of violent death are not necessarily attended with external signs indicative of violence.
3. That a child may be accidentally suffocated during delivery.
4. That the usual marks of death from suffocation or drowning are not apparent, except in the bodies of children which have breathed.
5. That the state of the navel-string may often furnish important evidence.
6. That a new-born child may speedily die from exposure to cold or from want of food.
7. That slight fractures of the bones of the cranium may arise from the action of the womb on the head of the child during delivery.
8. That women may be unexpectedly delivered while in an erect posture; the cord is under these circumstances sometimes ruptured, and the child may sustain injury by the fall.
9. That the violence found on the body of a child may be sometimes referred to attempts innocently made by a woman to aid her delivery.
10. That some women recently delivered may have sufficient strength to exert themselves and walk great distances.

CHAPTER 54.

DEATH OF THE CHILD FROM STRANGULATION.—STRANGULATION BY THE NAVEL-STRING.—ACCIDENTAL MARKS RESEMBLING THOSE OF STRANGULATION.—CONSTRICTION BEFORE AND AFTER DEATH.—BEFORE AND AFTER BREATHING. — BEFORE AND AFTER THE SEVERANCE OF THE NAVEL-STRING.—EXAMINATION OF WOMEN.—MEDICAL RESPONSIBILITY.

Among the forms of violent death which are generally attended with appearances indicative of criminal design, are the following:—

7. *Strangulation.*—The destruction of a new-born child by strangulation is not an unfrequent form of child-murder; and here a medical jurist has to encounter the difficulty that the strangulation may have been accidentally produced during delivery, by a twisting of the navel-string round the neck. We must not hastily conclude, from the red and swollen appearance of the head and face of a child when found dead, that it has been destroyed by strangulation. There is no doubt that errors were formerly made with respect to this appearance; for W. Hunter observed, 'When a child's head or face looks swollen, and is very red or black, the vulgar, because hanged people look so, are apt to

conclude that it must have been strangled. But those who are in the practice of midwifery know that there is nothing more common in natural births, and that the swelling and deep colour go gradually off if the child live but a few days. This appearance is particularly observable in those cases in which the navel-string happens to gird the child's neck, and where its head happens to be born some time before its body.'

Strangulation by the *navel-string* can, of course, refer to those cases only in which it becomes firmly twisted round the neck *after* the child has breathed. This is rather a rare occurrence, because under these circumstances death more commonly takes place by compression of the cord, and by the consequent arrest of circulation, before the act of breathing is performed. The only internal appearance met with in death from this cause is a congested state of the cerebral vessels, and ecchymoses. The presence of ecchymosis on the scalp, as well as of lividity of the face, is very common in new-born children when the labour has been tedious and difficult; and, therefore, unless there were some distinct marks of pressure about the neck, with a protrusion of the tongue, such appearances would not justify a suspicion of death from strangulation.

It has been supposed that the strangulation produced by the wilful application of any extraneous constricting force to the neck would be known from the accidental strangulation caused by the cord, by the fact that, in the former case, there would be a livid or ecchymosed mark or depression on the neck, while in the latter there would not. Severe violence to the neck of a new-born child may produce in the seat of constriction not only ecchymosis, but a laceration of the skin, muscles, and windpipe; but these appearances are not always present even in homicidal strangulation. Evans communicated to the author the particulars of the case of a new-born child which had been destroyed by strangulation. Great violence had been used, but there was no trace of discoloration in the course of the ligature, or of ecchymosis in the tissues beneath. The muscles compressed were very dark in colour. In most cases, when a ligature is applied to the neck during life, the skin above and below it becomes much swollen and presents an œdematous character. This indicates an application of violence when there is still some vital power in the body of the child.

The navel-string itself may be the means of constriction, and the mark or depression may sometimes present an appearance of ecchymosis. Among various cases which might be quoted in support of this statement, is the following. In 1846 Foster was summoned to attend a lady in labour with her first child. The labour was a lingering one, owing to the size of the head; and the child came into the world dead. The navel-string was found coiled three times round the neck, passing under the right armpit; and upon removing it *three parallel discoloured depressions* were distinctly evident. These extended completely round the neck, and corresponded to the course taken by the coils. The child appeared as if it had been strangled. ('Lond. Med. Gaz.,' vol. xxxvii. p. 485.) Had this child been born secretly, this state of the neck might have created a strong suspicion of homicidal violence. Strangulation after birth could not, however, have been alleged, because there would have been no proof of respiration. When a blue mark is found on the neck of a child whose lungs retain their fœtal characters, it is fair to presume, *cæteris paribus*, that it has been accidentally occasioned by the twisting of the navel-string during delivery. Price communicated to the same journal the account of a case in which the cord, which was short, was so tightly twisted around the neck of a child that he was compelled to divide it before delivery could be accomplished. There was in this instance a deep groove formed on the neck, conveying the impression to himself and another medical man that, in the absence of any knowledge of the facts, they would have been prepared to say that the child had been wilfully strangled by a rope. ('Lond. Med. Gaz.,' vol. xxxviii. p. 40.) A diagnosis might have been formed, as in the preceding case, by examining the state of the lungs. Mutter met with a case in which a child was born dead, and the cord was tightly twisted round its neck; when removed, the neck exhibited a livid circle of a finger's breadth, smooth and shining; but on cutting into this mark, no ecchymosis was found. ('North. Jour. Med.,' 1845, p. 190.) In *Reg.* v. *Martin* (Lewes Lent Ass., 1860), the material question was whether a mark round the neck had been caused accidentally by the navel-string; this was denied by the medical witness. A similar question also arose in another important case, *Reg.* v. *Pyne* (Gloucester Winter Ass., 1858).

Williamson has directed attention to an important fact connected with the state of the lungs in a new-born child, and the medical opinions which may be expressed from their condition as furnishing evidence of live birth. Referring to Price's case (*supra*), in which the cord was tightly twisted round the neck of the child, he states that in similar cases which have occurred to himself, the child has breathed immediately on the birth of the head; but, owing to the shortness of the cord, the child would have been strangled and born dead unless he had divided it. Thus, then, a child might die apparently strangled, and not be born alive, although it might have so breathed during birth that the lungs would present the usual characters of respiration. If the circumstances were not known, a medical man might be led to say that the child had been born alive and had been destroyed by strangulation. ('Edin. Med. Jour.,' 1858, p. 714.) The proof of respiration, as it has been elsewhere stated, is, however, not necessarily a proof of live birth. From these cases it will be perceived that ecchymosis in the depression on the neck furnishes no distinction between constriction produced by criminal means, and that which may result accidentally from the navel-string. In the following case ('Ann. d'Hyg.,' 1841, t. 1, p. 127), a woman charged with the murder of her child by strangulation appears to have been unjustly condemned. The child had fully and perfectly breathed; the lungs weighed one thousand grains, and, when divided, every portion floated on water, even after firm compression. There was a circular depression on the neck, which was superficially ecchymosed in some parts. From an investigation of the facts, this appeared to have been a case in which a mark on the neck was accidentally produced by the cord, during attempts at self-delivery on the part of the woman: she was, nevertheless, convicted, chiefly from the opinion expressed by two medical witnesses, that a soft and yielding substance like the cord could *not* produce a depression and ecchymosis on the neck of a child during birth. They attributed the mark to the wilful application of a ligature like a garter; but the experiments of Négrier clearly show that the navel-string has sufficient strength to produce a mark, and with it a fatal constriction. ('Ann. d'Hyg.,' 1841, t. 1, p. 127.)

In the same volume of the 'Ann. d'Hyg.' (at p. 428) will be found the report of another case, suggesting many important reflections in regard to the medical jurisprudence of infanticide. In this instance the navel-string and the membranes were actually used by a woman as a means of strangulation; the child had not breathed, but was by this act of violence prevented from breathing. There was superficial ecchymosis on each side over the muscles of the neck. The defence was that the child was born with the cord around its neck, and that it was from this circumstance accidentally strangled; but the medical evidence tended to show that the cord had been violently stretched, and employed as a means of strangulation. The child had *not breathed*, and the medical witnesses considered that it had been born dead, owing to the violence used by the woman. The cause of death here was certainly not strangulation, but arrested circulation. In the mean time, the case proves that ecchymosis (a blue mark) may be the result of violent constriction produced by the navel-string. A case occurred to M'Cann, in which the navel-string, which was of its full length, had been also used as the means of strangulation. It was twisted once round the neck, passed under the left arm, over the shoulders, and round the neck again, forming a noose or knot, which, pressing upon the throat, must have caused strangulation, as the tongue was protruded, and there were other clear indications of the child having been strangled. The hydrostatic test applied to the lungs proved that respiration had been performed.

When the mark on the neck is deep, broad, much ecchymosed, and there is extravasation of blood beneath, with injury to the muscles or windpipe, and ruffling or laceration of the skin, it is impossible to attribute these appearances to accidental compression by the navel-string. The lividity produced by it in the cases hitherto observed has been only slight and partial, and unaccompanied by laceration of the skin or injury to deep-seated parts. On the other hand, as much more violence is commonly used in homicidal strangulation than is necessary for destroying life, we may expect to find great ecchymosis and extensive injury to the surrounding soft parts. On some occasions all difficulty is removed by the discovery of a ligature, tied tightly round the neck; or, if this be not found, the proofs of some ligature having been used will be discovered in the indentations or irregularly ecchymosed spots left on the skin—the depressed portions of skin being generally white, and the raised edges livid or œdematous.

It has been doubted whether a child can be born with the navel-string so tightly round the neck as to produce great depression of the skin and ecchymoses, *i.e.* to simulate homicidal strangulation, and at the same time perform the act of respiration fully and completely. It is important, therefore, when this hypothesis is raised in order to account for a suspicious mark on the neck, to examine closely the state of the lungs. Unless the cord be designedly put round the neck of the child *after* the head has protruded, the effect of the expulsive efforts of the womb, when a coil has become *accidentally* twisted round the neck, would be to tighten the cord, compress the vessels, and kill the child by arresting the maternal circulation, at the same time that this pressure would effectually prevent the act of breathing. Hence the lungs usually present the appearances met with in still-born children generally; but the case which occurred to Williamson (p. 618) shows that this state of things may sometimes occur, and that a child may breathe, and die strangled by the cord before its body is entirely born. Medical witnesses, however, should not be too ready to accept such a suggestion: a careful examination of the neck will generally show whether a ligature has or has not been wilfully applied after birth. In *Reg.* v. *Robinson* (Lewes Sum. Ass., 1853), there was around the neck the mark of a ligature which had been *tied very tightly.* The child had fully breathed, and, according to the medical evidence, it had died from strangulation, owing to an accidental twisting of the cord during delivery. In examining a suspicious mark on the neck of a new-born infant, it should be noticed whether it does not, by its form or course, present some peculiar indentations which may render it certain that a ligature has been wilfully employed after birth. When it is found that a child has fully breathed, the presence of a deeply ecchymosed or an œdematous mark on the neck with injury to the skin and muscles is, *cæteris paribus*, presumptive of homicidal strangulation. Death from accidental constriction of the cord during delivery should, as a general rule, leave the lungs in their fœtal condition.

Marks on the neck of a child may be accidentally produced by the navel-string without necessarily destroying the child's life. Two cases of this kind are reported by Busch ('Brit. and For. Med. Rev.,' vol. x. p. 579); and a child may be destroyed without ecchymosis being a necessary consequence of the constriction produced by it. There is much less risk of strangulation from twisting of the cord during birth than is commonly believed. Out of 190 cases, Churchill found the cord round the neck in fifty-two children, and the shortest cord so disposed was eighteen inches long; Négrier found it round the neck in twenty cases out of 166 natural labours. ('Ann. d'Hyg.,' 1841, t. 1, p. 137.)

The *appearances* met with in the body in death from strangulation have been elsewhere fully considered (p. 429, *ante*). The facts of a case communicated to the author by Cann will, however, serve to show the appearances which may present themselves in a new-born child. A woman was secretly delivered of a child. When the body was found, it was observed to be full-grown, and there was a piece of tape which had been tied tightly in a bow, twice round the neck. The tongue protruded between the lips; two deep furrows were found round the neck after the removal of the tape; there was great œdema with swelling of the skin between and above them, and the right hand was clenched. The lungs were of a light-red colour; they filled the chest, were highly crepitant, and floated readily on water, even when divided into sixteen pieces, and these had been submitted to strong pressure. They weighed, however, only 626 grains. The heart was healthy: the right side contained some clots of blood; the left side was empty; the foramen ovale was open. The scalp was much congested, the congestion almost amounting to small effusions of blood; the pia mater was also congested. The inferences drawn from these facts were that the child had been born alive, and that it had died from strangulation. The lungs were as light as they usually are in the fœtal state, showing that, although they had received air, the pulmonary circulation had not been perfectly established. Juries take a very lenient view of these cases of death by strangulation. In *Reg.* v. *Cresswell* (Gloucester Spring Ass., 1878), the child was found dead with a cord tied tightly round its throat. It was clear that it had been born alive, and had died from strangulation. It was suggested for the defence that the cord was tied round the throat to conceal the birth, and not with intent to murder. The woman was found guilty of manslaughter.

Accidental Marks resembling those of Strangulation.—In the fore part of the neck of a child a mark or depression is sometimes accidentally produced by forcibly bending the head forwards on the chest, especially when this has been done repeatedly and recently after death, while the body is warm; especially if it be fat. It may occur also as an accident during labour. Such a mark must not be mistaken for the effect of homicidal violence. It has been a question whether, independently of the constriction produced by the cord, the neck of the womb might not cause, during its contractions, an ecchymosed mark on the neck. We are not aware that there is any case reported which bears out this view; and it seems highly improbable that any such result should follow.

The discoloration may be in detached spots or patches, situated in the fore part of the neck, and evidently not arising from the employment of any ligature. These marks may depend on the forcible application of the fingers to the fore part of the neck of the child, and the indentations have been known to correspond—a fact which has at once led to a suspicion of the cause of pressure and the mode of death. At the same time, it should be borne in mind that a superficial mottling of the skin occurs after death in new-born infants, in parts where moderate pressure only may have been accidentally produced. This would not be attended with ecchymosis, and its true nature would be at once determined by comparing the discoloured spots with the surrounding skin. It may be alleged, in defence, that such marks might have been accidentally produced: 1. By the forcible pressure produced by the child's head during labour. 2. They will be more commonly referred to violent attempts made by a woman at self-delivery, during a paroxysm of pain. This explanation is admissible, so long as it is confined to injuries which, by any reasonable construction, might be caused during labour; but supposing the marks to have been certainly produced after the complete birth of the body, it will, of course, not apply (see also p. 598).

Among marks simulating violence, which are sometimes found on the necks of new-born children, Harvey has pointed out one of a singular kind. He was present at a delivery in which a child was expelled rather suddenly; and, after making two or three convulsive gasps, it died. Whilst endeavouring to restore animation, he observed a bright-red mark extending completely across the upper and fore part of the neck, from one angle of the lower jaw to the other, as though it had been produced by strangulation with a cord, except that the mark was not continued round to the back of the neck. It was of a vivid red colour, and not like a bruise or ecchymosis, but it had very much the appearance of a recent excoriation. It was most clearly defined in front, where it was about a quarter of an inch in breadth, and it became diffused at the sides. The face was not swollen, and there was no fulness of the veins. ('Lond. Med. Gaz.,' vol. xxxix. p. 379.) A distinction in this instance might have been based upon the colour of the mark, the uninjured state of the cuticle, and the absence of congestion of the face and venous system. Nevertheless, the fact is of some importance, and should be borne in mind during the examination of the body of a new-born child alleged to have been strangled. Another case, which was the subject of a coroner's inquest, was published in the same journal (vol. xxxvii. p. 530), in which red marks on each side of the nose of a new-born child were mistaken for the effects of violence applied to the nostrils during a supposed attempt at suffocation. Rose examined them closely, and considered that they were nævi (mother's marks), and had nothing to do with the death of the infant.

A medical witness may be asked on these occasions whether he will undertake to swear that the ligature or the fingers had been applied to the neck of a child before or after its death, or before or after it had breathed. It is proper to observe that, so far as external marks of strangulation are concerned, there is no difference in the appearances, whether the constriction is made during life or immediately after death while the body is warm. Casper's experiments render it highly probable that, when a constricting force is applied to the neck of a dead child, at any time *within an hour* after death, the marks cannot with certainty be distinguished by any appearance from those made on a living body. With regard to the second point, it may be stated that, whether the child has breathed or not, provided it be *living* and the blood circulating, marks of violence on the neck will present precisely the same characters. In the absence of any visible discoloration of the skin, it may be a question whether this should be taken as evidence of the means of constriction not having been applied during life. What we are entitled to say from observed facts is that ecchymosis from the ligature is not a necessary consequence of constriction, either in a living or a recently dead child; although we might expect that there would be few cases of deliberate child-murder in which, when strangulation was resorted to, there would not be some ecchymosed mark or discoloration, chiefly from the presumption that great and unnecessary force is suddenly applied. Besides, it is not improbable that a slighter degree of force would cause ecchymoses on the skin of a new-born infant, than would be required to produce such an appearance on that of an adult.

Another question has been put—namely, whether a medical witness will undertake to say that the constricting force has not been applied to the neck of the child until after its body has been entirely born. This, of course, must be a pure matter of speculation. The appearance caused by a ligature applied to the neck of a *living* child would not be different whether the child was partially or entirely born. If the child had actually breathed, the appearances in the body would be the same, and there are no medical facts by which it could be determined whether the act of strangulation proved fatal during birth or afterwards. A medical witness has also had this question put to him—whether the strangulation occurred before or after the navel-string was severed. It would appear that the severance of the cord has been sometimes regarded as a legal test of an independent circulation being established in the child; but this is obviously an error, depending on a want of proper information respecting the phenomena which accompany birth. Respiration, and therefore an independent circulation, may take place *before* the cord is divided; and its severance, which is never likely to occur until after entire birth, cannot consequently be considered as a boundary between a child which is really born alive and one which is born dead. A premature severance might possibly endanger the life of a child, instead of giving it an independent existence. A healthy and vigorous child may continue to live and breathe independently of the mother, before the division of the cord, and the time at which the severance is made, depends on mere accident. Hence the marks of strangulation on the neck of a living and breathing child must be the same whether the cord has been divided or not. The entire birth of the body is, however, now considered to be legally complete, although the navel-string has not been divided.

8. *Poisoning.*—This is placed among the possible means of perpetrating child-murder; but we rarely hear of *new-born* children being thus destroyed. Children destroyed within a week of birth generally die from some acts of violence like these already described, the object of the perpetrators of the crime being to ensure a rapid and certain death. Hofmann describes a case in which a girl destroyed her child by nux vomica on the second day after birth. She mixed the powder with camomile tea, and gave it to the child. It had convulsions, and died in three hours. Cadaveric rigidity was strongly developed in the

body of the child when found on the third day. No particular appearances were met with except those of asphyxia in the chest. No trace of strychnine was detected in the stomach or liver. A trial took place for the murder of a child by poison at two months. (*Rex* v. *South*, Norf. Aut. Circ., 1834.) Arsenic was given to an infant, and it died in three hours and a quarter after the administration of the poison. The editor gave evidence as to the administration of butter of antimony to an illegitimate child, four days old, whereby its death was caused. The mother and grandmother were tried for murder (*Reg.* v. *Wallis and Wallis,* Worcester Sum. Ass., 1883), but were acquitted, there being no sufficient evidence as to the actual administration of the poison by the prisoners. If, in a case of child-murder, death from poison should be suspected, it must be sought for in the usual way. Some cases have occurred in which children have been wilfully destroyed a week or two after birth, by the administration of opium or excessive doses of purgative medicine. Oil of vitriol has been also used to destroy life.

In cases in which infants are destroyed by poison, there is generally great difficulty in tracing the act of administration to the guilty person. The fluid food given to them renders the admixture of poison easy, and as many persons may have access to this food, it is often impossible to fix upon the criminal. In one instance which came to the author's knowledge, an illegitimate child had been placed out to nurse by its mother, a woman in a good social position. It was noticed that after each visit paid by the mother the child was sick, and after repeated attacks of illness, the child died. On inspection, arsenic was found in the body, and this was beyond doubt the cause of death. There was no suspicion against the nurse; but suspicion fell on the mother, from the circumstances above mentioned. There was evidence, however, that the child was not at any time fed by the mother when she visited it, and that the mother had no access to the child's food. No poison could be traced to her possession, and she was not seen by the nurse, who was present, to give anything to the infant. The only fact that transpired was that, at each visit, she took it in her arms and was observed to rub its gums with her fingers, and soon after her visits, sickness followed. There was reason to believe that she had concealed small quantities of arsenic under her finger-nails, and that she had administered the poison while rubbing the gums of the child.

Conclusions.—The following conclusions may be drawn from the preceding remarks:—

1. That congestion of the face and head in a new-born child is not a proof of death from strangulation.
2. That strangulation can take place only in children which have breathed.
3. That a child may be strangled during birth by the accidental twisting of the navel-string round its neck.
4. That the navel-string may produce a livid or ecchymosed depression on the neck, like any other ligature.

5. That marks on the neck produced by accidental causes may resemble those which arise from strangulation.

6. That the effect of constriction on the neck, either by the navel-string or any other ligature, is the same, if the child be *living*, whether it has or has not breathed.

7. That the effect is the same whether the child has been *partially* or *entirely* born.

8. That the effect of a ligature on the neck of a *living* child is the same whether the navel-string has or has not been severed.

9. That a new-born child may die from strangulation, without this fact being necessarily indicated by ecchymosis on the neck. This depends on the nature of the ligature and the amount of force used.

Examination of Women. Medical Responsibility.—In general, it is the mother of the child who is charged with the murder, and in this case it may be necessary, in order to connect her with the child, to determine whether she has or has not been *recently delivered.* Medical evidence may show that the date of delivery does or does not correspond with the date of the birth and death of the child. The usual appearances in cases of recent delivery, both in the living and dead body, have been elsewhere fully described. (See Delivery, *ante*, pp. 521–524.) These appearances necessarily vary according to the time at which the examination is made. Toulmouche has reported in detail several cases showing the post-mortem appearances met with at different dates. ('Ann. d'Hyg.,' 1864, t. 2, 349.)

If the reputed mother of the child is *dead*, a coroner or magistrate may issue an order for a post-mortem examination of the body, and the case will present no difficulty; if *living*, a serious question may arise as to medical responsibility. In general, a woman consents to be examined, but it may happen that she will refuse to submit to a physical examination. An innocent woman is just as likely to refuse permission as one who is guilty; but, if circumstances point to one out of several women in a household, the refusal to permit an examination would, of course, be interpreted against her. It has happened on more than one occasion that medical men have assumed to themselves the right of enforcing an examination of suspected women, and, by threats or otherwise, they have compelled them to undergo this. Such a course of conduct is in the highest degree indecent and improper; but when a woman willingly consents to be examined, a medical man is justified in making an examination, and giving evidence thereon. It would, however, be only fair in such a case to give her the warning which every magistrate and coroner is bound to give to any woman charged with murder, before requiring an answer to a question which may be used in evidence against her at the subsequent trial. The case is widely different, however, when a medical man takes this authority upon himself, and compels a suspected woman, unwillingly, or under duress, to submit to a physical examination. By taking this illegal course, he is forcibly compelling a woman accused of murder to produce positive proof of her guilt; such a course is entirely opposed to the spirit and practice of English jurisprudence. The mischievous results of such officiousness on the part of a medical man are well illustrated by the following cases. A surgeon and an inspector of police insisted upon examining two women, a mother and daughter, in order to determine whether either of them had been lately delivered of a child. This was against their consent, and in the absence of the husband and father. He brought an action against them, and recovered damages. ('Lancet,' 1871, ii. p. 333.) The other case was that of *Weir and Wife* v. *Hodgson.* (Liverpool Wint. Ass., 1861.) The dead body of a child had been found near the house of the plaintiff. The defendant, a surgeon, went with an inspector of police to see Mrs. Weir; and, having informed her that she was suspected of having had a child, told her that he had come to examine her by the authority of the law, and that she must submit. She refused at first, and proposed to send for a medical man whom she knew. In the end, the defendant examined her, and found that there was no ground for the charge. The jury returned a verdict of 200*l.* damages for the assault. The police can give no legal power to a medical man to make such an examination in a suspected case, and the ultimate consent of the woman, if extorted by threats or intimidation, will be no answer to a charge of indecent assault. A later case (*Warne* v. *Serjeant*) was tried at the Manchester Wint. Ass., 1878. It was here doubtful whether the woman had given her consent to an examination, and the jury found a verdict for the defendant. The judge observed that, even if the surgeon had been honestly misled by the woman's conduct, it would still be an assault. In all cases, whether the charge against a woman be one of concealment of birth, abortion, or child-murder, a medical man must act upon his own discretion. An examination of her person, with a view to obtain evidence against herself, is unlawful, except with her free consent.

A coroner issuing an order for the compulsory examination of a woman under these circumstances, would be acting *ultra vires*, and any medical man obeying it would incur a serious responsibility. In 1871 a case occurred that placed this question in cases of alleged infanticide in a painful light. A young lady committed suicide rather than submit to a physical examination by two medical men under the order of a coroner. The coroner held an inquest on the body of a child in a case of alleged child-murder. A suspicion arose that this young lady had been recently delivered. Two medical gentlemen, provided with a written order from the coroner, went to the house where the lady resided, and requested an interview with her for the purpose of ascertaining whether she had recently had a child. She refused to see them, and subsequently destroyed herself. All the particulars of this tragedy were not made known, but the attempt to examine this young woman for the purpose of obtaining evidence against her on a charge of child-murder appears to have had such an effect on her mind as to lead to suicide. The fragmentary particulars of this sad case will be found in the 'Lancet' for 1871, vol. ii. pp. 333, 471, and 477. The 6 & 7 Will. IV., c. 89, under which an order was issued by the coroner on this occasion, empowers a medical man to examine a *dead* body, and give evidence touching the cause of death; but it says nothing about the examination of *living* women. Such an order would be obviously illegal, and a medical man acting under it would render himself liable to an action for an indecent assault.

It can be only by the free consent of the person inculpated that a personal examination for evidence can be made. The *Tichborne* trial furnished a good illustration of the care taken by our judges that an accused person shall not unknowingly furnish evidence against himself. It was alleged on this occasion that if the 'claimant' had been bled in the temporal artery, a scar would remain; and a proposition was made that he should be then examined by two medical witnesses who had been called for the prosecution. Cockburn, L.C.J., ruled that such an examination could not be made except by the consent of the accused. This was given, and the examination accordingly took place in court. A similar rule has been long acted on in the Scotch courts. Thus in a divorce case, tried in 1860 (Edin. Sess. cases, 1860), the court refused to receive certain evidence which was tendered regarding the condition of a woman, on the ground that they could not compel her to submit to another examination, and the evidence tendered would therefore have been entirely *ex parte*. In a suit of nullity in the Divorce Court, Hannen, J., was obliged to decide the case upon the evidence of the husband only. The wife refused to submit to an examination, and there was no legal power to compel her to undergo this against her will. (*Hewitt* v. *Pery*, falsely called *Hewitt*, July, 1873.) These cases suffice to show the course which a medical witness should pursue on all occasions in which a person does not voluntarily consent to a personal examination.

BIRTH. INHERITANCE.

CHAPTER 55.

LIVE BIRTH IN CIVIL CASES.—DATE OF BIRTH.—SIGNS OF LIVE BIRTH INDEPENDENTLY OF RESPIRATION OR CRYING.—VAGITUS UTERINUS.—TENANCY BY COURTESY.—LEGAL BIRTH.—POST-MORTEM BIRTHS.—MINORITY AND MAJORITY.—PLURAL AND MONSTROUS BIRTHS.

Date of Birth.—Medical evidence has occasionally been demanded in courts of law respecting the actual date of birth in those cases in which a period of a few days, hours, or even minutes was required to prove the attainment of majority,—and therefore a legal responsibility for the performance of civil contracts into which the parties had entered, either knowingly or ignorantly, when minors. Some such cases have been decided by the evidence of the accoucheur himself; others, when the accoucheur was dead, by the production of his case-books; and it is worthy of notice that the strictness and punctuality of some medical practitioners, in making written memoranda of cases attended by them, have in more than one instance led to a satisfactory settlement of such suits, and the avoidance of costly litigation. The proof of the exact date of birth is also of considerable importance in certain cases of contested legitimacy.

Medico-legal questions connected with this subject arise in contested suits relative to succession or the inheritance of property. A child that is born alive, or has come *entirely* into the world in a *living* state, may by the English law inherit and transmit property to its heirs, even although its death has immediately, and perhaps from morbid causes, necessarily, followed its birth. Should the child be born dead, whether it died in the womb or during the act of birth, it does not acquire any civil rights; for it is not regarded as a life in being, unless it manifests some sign of life *after* it is entirely born and separated from the mother. Some have considered that *partial birth*, provided a child is living, should suffice to confer the same rights on the offspring as the proof of entire birth; but great difficulty might arise in civil cases, if the bare extrusion of a *part* of the body sufficed for all the legal purposes of *entire* birth. It might become a casuistical question, as to how much of a body should be in the world in order to constitute legal birth; for there is no reason why, in a medical sense, the extrusion of the head and shoulders should constitute birth any more than the extrusion of a hand or a foot. If it be said that the act of breathing should be combined with a partial extrusion of the body, this would be unjust; because a child is alive—its heart is evidently pulsating, and its blood circulating, as freely before the act of breathing as afterwards. Besides, it is admitted that children may be born alive, and live for some time without respiring; and this want of respiration is no objection to these children being considered living in law. In a case referred to hereafter, a child was pronounced to have been legally born alive, although it had certainly not breathed; and that a child may manifest life for a certain time without leaving in its body any evidence of respiration is clear from numerous reported cases (p. 574, *ante*). If, then, proof of respiration be not demanded in cases of entire, it could scarcely be required in cases of partial, birth. In the event of partial being treated as synonymous with entire birth, there would be no end to litigation; and medical opinions would vary in every case. It is doubtful whether, under such circumstances, the law could be administered with any degree of certainty or impartiality. Admitting, then, that a child must be *entirely* born in order that it should acquire civil rights, it will next be necessary to examine the proofs required to show that it has been *born alive* in a legal sense. The question here is different from that of live birth in reference to child-murder. We may presume that a practitioner is present at a delivery in which a child is born in a doubtful state, or where its death speedily follows its birth. The civil rights of the child and its heirs will depend upon the careful observation made by a practitioner of the circumstances attending the delivery. He should note the time when the birth is completed, by the body of the child being entirely out of the body of the mother. Children born at or about midnight are liable to have the date of birth wrongly registered; and the legal difference of twenty-four hours, which a few seconds or minutes make, may hereafter affect their own rights, if they survive, or those of others if they die.

Signs of Live Birth independently of Respiration or Crying.—The visible breathing of a child after its birth, or as it may be manifested by its *crying*, is an undoubted sign of its having been born alive; but, as it has just been stated, a child may acquire its civil rights, although it may be neither seen to breathe nor heard to cry. The pulsation of a child's heart, or even the spasmodic twitching of any of the muscles of the body, has been regarded as a satisfactory proof of live birth (p. 630). The latter sign has been judicially so pronounced; *à fortiori*, therefore, the motion of a limb will be considered sufficient legal evidence of life after birth, in an English court of law. It is to be observed that the length of time during which these signs of life continue after a child is born is wholly immaterial; all that is required to be established is that they were positively manifested. A child which survives entire birth for a single instant acquires the same civil rights as if it had continued to live for a month or longer.

In *Brock* v. *Kelly* (April, 1861), involving a claim by the widow to the estate of her husband, on the ground that a child born twenty years before had been born living, although it was at first supposed to have been still-born, Stuart, V.C., decided that proof of breathing was not necessary, and held that there was sufficient legal evidence of life after birth in the pulsations of the cord observed by the accoucheur. This decision is in accordance with law and common sense. Pulsations indicate an independent action of the fœtal heart as much as a motion of the chest indicates an action of the intercostal muscles. Why it should be maintained that there is life with contractility of the intercostal muscles, but not with a contractile power of the heart, is not apparent; that this view is not in accordance with facts, is, however, proved by several cases which are described under Infanticide. (See Atelectasis, p. 573, *ante.*)

There is no doubt that the best test to apply to such cases for the determination of *physiological* life is *auscultation*. The beating of the heart, as determined by the ear or the stethoscope, applied even for five consecutive minutes, is an undoubted sign of life in a physiological sense, whether the child breathes, cries, or moves. Bouchut noticed on one occasion, that this kind of passive life continued in an infant for twenty-three hours after its birth. Feeble but distinct pulsations were heard at long intervals, but there was no motion of the ribs. Attempts at resuscitation were made, but the motions of the heart became more and more feeble, until they entirely ceased. An examination showed that the lungs had not received air. As we take the cessation of the heart's action to be the only certain evidence of death, so the existence of pulsations in the heart or arteries, when clearly perceived by the ear, stethoscope, or finger, is positive evidence of life in a physiological sense. Is this *legal* life? Would the wilful destruction of such a child constitute murder? Would this proof of pulsation without motion, respiration, crying, or any other sign of active life, confer tenancy by courtesy, or transfer an estate by inheritance or survivorship? Bouchut justly observes that apparent death succeeding to birth, and characterized by the presence of a beating of the heart and an absence of breathing, is only a morbid condition of the new-born child (see p. 574, *ante*); and, whether it is cured of this or dies, it is living, although it has not breathed—or, as a German jurist remarks, '*Scheintod ist Scheinleben.*' They who contend that crying or breathing alone should be taken as a sign of life after birth, would of course pronounce such a child to have been born *dead*, even at the time that they might be listening to the pulsations of its heart. (Casper, 'Klin. Novel.,' 1863, p. 564.)

Vagitus Uterinus.—Let us suppose that the evidence of a child having been born alive is stated to be that it was heard to cry; it may be a question for a medical witness, in cross-examination, whether this is to be taken as an absolute proof of live birth. The answer must be in the negative, because a child may cry before its body is entirely born; or there may have been what is called *vagitus uterinus*—a uterine cry after the rupture of the membranes. (See Infanticide.) It is quite certain that a child may breathe without crying, but it cannot cry without breathing; yet neither the crying nor the breathing is a necessary proof that the child was actually born alive. A child may breathe in the womb or vagina, or with its head at the outlet, and die before its body is born: the discovery of its having breathed would not, therefore, be proof of its having enjoyed what has been termed 'extra-uterine life.' As in all cases of this description there must be eye-witnesses, either professional or not, the evidence will not rest solely upon a merely medical possibility of the occurrence of such a cry before birth; and proof will then be required of the crying of the child *after* it was born. The determination of the momentary existence of children after birth is of importance in a legal point of view in reference to the following subject.

Tenancy by Courtesy.—This signifies, according to Blackstone, a tenant by the courts of England. When a married woman possessed of estate dies, the estate passes from the husband to her heir-at-law, unless there has been a child born *living* of the marriage during the life of the wife, in which case the husband acquires a life-interest in the property. This custom is of great antiquity. Incurable sterility, a protracted labour, deformity in the pelvis of the wife, or the necessary performance of craniotomy on a healthy well-formed child, may, under this custom, lead to an aversion of the inheritance. The tenancy, in contested cases, is generally established or disproved by medical evidence; and the following are the conditions which the law requires in order that the right should exist:—

1. The child must be born *alive.* Cases have been already referred to in which the motion of a lip and the pulsations of the navel-string

were held to be sufficient legal proofs of live birth. Some physiologists have objected to these as inadequate proofs of life in a medical sense; and if the question were one of pure physiology, and not of law, there might be some ground for the objection. The law, however, does not require proof of *active* life in a child, but merely some evidence, however slight, that it has been born *living*.

The *crying* of a child, properly attested by disinterested witnesses, has been held in cases of disputed tenancy to be sufficient evidence of live birth; this is, in fact, one of the tests given by Lord Coke. At page 573, *ante*, some cases are related in which new-born children survived birth several hours, but manifested no sign of active life either by crying or in any other mode, and after death there was no air in the lungs. As in cases of infanticide, if the evidence of live birth rests entirely on an examination after death, the absence of air from the lungs will not necessarily show that a child has come into the world dead, nor will the presence of air in these organs prove that it has been born alive, because it may have breathed and died before birth. The child must be heard to cry, or be seen to breathe or move after birth. The fact that the lungs are not distended with air, and that they sink in water, either when entire or when divided into small pieces, is no proof that a child has not breathed and cried during birth and afterwards. It does not require full inflation of the lungs for these conditions to exist. Barnes found that the lungs of children which had cried during birth sank in water. A woman was suddenly delivered at five months and a half. The child cried loudly when born. It survived forty-four hours. The eyelids were perfectly closed. It weighed one pound and a quarter, and was eleven inches in length. ('Obst. Trans.,' 1875, vol. xvi. p. 86.) At p. 227 of the same volume, there is another case of a child born at the sixth month, which cried loudly several times, and lived twenty-one hours. It weighed one pound six ounces, and measured twelve inches in length. In a third case, which occurred to Vernon (p. 575, *ante*), a six months' child was strong enough to cry; yet the lungs contained no air and sank in water. A child born at the fifth month has been known to cry; but the state of its lungs is not recorded. In the case of *Gardner* v. *Llewellyn* (1856), a medical witness, who appeared for the plaintiff, stated as his belief that a child born at the fifth month could *not respire,* and if it could not breathe (so as to fill the lungs) it could not cry. This is not consistent with facts observed by others.

2. The child must be *born* while the *mother* is *living*. From this it appears that, if a living child were removed from the outlet, or extracted from the womb by the Cæsarean operation after the death of the mother, the husband would not become entitled to enjoy his wife's estate; although the child might survive its removal or extraction, and succeed to the estate on attaining its majority. How such a case would be decided in the present day it is difficult to determine; but one instance is quoted by most medico-legal writers from Lord Coke, in which, about three centuries since, the decision went against the

husband, in consequence of the child having been removed from the womb by the Cæsarean section *after* the death of the wife. (For a case involving this question in France, see 'Ann. d'Hyg.,' 1838, t. 1, p. 98.) In the case of *Llewellyn* (p. 631), Alderson, B., ruled that the husband could not take the estate unless the child was proved to have been born during the marriage, *i.e.* during the life of the woman. This question was raised on appeal in the case of *Treherne* v. *Layton*, June, 1875. An estate had been left to the wife by her grandfather, after her death to her children, and in case she died leaving no issue, then to his next of kin. She had a child, which just breathed and then died; and after her own death the estate was claimed by the next of kin, while the husband, the father of the child, claimed it as his child's heir-at-law. It was not disputed that the wife died 'leaving no issue,' but it was contended for the husband that the estate was vested in his child by its momentary life, and all the judges held that it could not be devested by the child's death. The old custom of tenancy by courtesy was thus confirmed, in spite of the words in the grandfather's will.

Cæsarean Extraction.—The Cæsarean operation has rarely been performed in England, except when a woman was actually dying or dead. A medical man wishing to perform it may find that the husband or representative of the deceased parturient woman will object to its performance, although the child may be living in the womb, and there may be a reasonable hope, by an immediate operation, of extracting it living. On two occasions in 1858, the husbands thus refused to allow Lever to operate on the dead body of the wife. We apprehend that no medical man would proceed to operate by force, or against the will of the husband; at the same time, in refusing his permission, the husband is not guilty of any legal offence. The practice on the Continent has been to undertake it while the woman was living, and the result has shown that it may be performed successfully both with regard to mother and child. In cases in which a tenancy by courtesy would be likely to arise, it would be to the interest of the husband to allow the operation of extraction to be performed while the wife was living; but he would have no such interest in its performance after her death; and if the child has not attained a sufficient stage of maturity to survive, there can be no reasonable object in performing it. Important legal consequences may hereafter ensue from a more general adoption of this practice in England in respect to deformed women. Thus, supposing in any case a child were removed alive while the woman was living, both of them dying shortly afterwards, would the husband become a tenant by her courtesy? The law says the child must be *born*; and it might be argued whether extraction by the Cæsarean operation should be regarded as 'legal birth.' 'Illud autem valdè controversum est inter jurisconsultos, an is qui editus est, exsecto matris ventre, reputetur partus naturalis et legitimus et successionis capax.' (Caranza.) According to Fonblanque, the question is settled in the affirmative—a child extracted is a child born. ('Med. Jur.,' vol. 1, p. 236.) Our ancient law authorities do not appear to have contemplated that the operation would ever be undertaken on a living female. The words of Lord Coke, which are considered to express the state of English law, are: 'If a woman seised of lands in fee taketh husband, and by him is bigge with childe, and in her travail dyeth, and the child is ripped out of her body alive, yet shall he not be tenant by the curtesie, because the child was not born during the marriage, *nor in the life of the wife*, but in the meantime her land descended.' According to Hobler, the Cæsarean operation does not divert the course of descent, or devest the husband of the life-estate, provided the child be born alive, and the mother was living when the child was born. ('Obst. Rec.,' vol. ii. p. 66.) *Birth*, and extraction by the Cæsarean operation, are, therefore, treated by him as similar conditions.

There is no law to compel a man to perform this operation, and no law to prohibit it. Some years since the duty of a medical man on these occasions was made a subject of investigation by a committee of the French Academy of Medicine, and the conclusion at which they arrived was that, in the case of a pregnant woman recently deceased, a medical man might and ought to perform the Cæsarean operation, if there were any probability of removing from her body a child in a viable state, *i.e.* with a power to maintain an extra-uterine life. The date of viability, according to some authorities, is fixed at the 108th day. Hence it is advised that no operation should be performed on a woman unless her pregnancy has reached this date. English practitioners would not be guided by any fixed period, but by the circumstances attending each case.

As a proof that the operation is not always necessary, even when circumstances may appear to call for it, the following case, mentioned by Brodie as having occurred in a French hospital, is of some interest. It is that of a woman whose pelvis was considered to be too narrow for the egress of the child. As she was at the full term of gestation, the Cæsarean section was proposed; but before the operators were ready to commence, the child was expelled by the natural efforts of the womb, or, 'the child preferred coming into the world by the old road!' This, however, is not the only case of the kind on record. There is reason to believe that Continental practitioners have been too officious in suggesting the performance of this operation, and that it has been often undertaken, to the serious risk of the life of a woman, when, if left to nature, she would have done well. A case is reported to have occurred in Scotland in 1847, in which the Cæsarean operation was considered by several practitioners of experience to be the only means by which delivery could be accomplished. Fortunately for the woman, the labour was somewhat rapid, and she was delivered of a dead child, weighing about three pounds, before the arrival of those who had considered that the operation would be required. ('Edin. Month. Jour.,' 1847, ii. p. 30.) The fact is, on these occasions nature often adapts means to ends in a most unexpected manner.

Medical jurists have differed respecting the period of gestation at which the operation should be performed. This would, of course, depend on the earliest period at which a child might be born capable of living. In reference to tenancy by courtesy, a child might be extracted alive as early as the fifth month, but it would not be likely to survive unless it were at or about the seventh month. When a woman dies undelivered, it is difficult to say for how long a period the child may survive in the womb. It has been stated that a child may thus continue to live for many hours, but this is not borne out by any facts, and the physician who makes the suggestion admits that no time should be lost in removing it from the womb. In the case of *L'Hotellier* ('Ann. d'Hyg.,' 1838, t. 1, p. 98), the child was removed alive a quarter of an hour after the death of the woman. Madge operated in a case of convulsions *twenty minutes* after the death of the woman, but the child was then dead. There were no signs of uterine action after the mother's death. ('Amer. Jour. Med. Sci.,' 1872, p. 585.) Some have alleged that, unless the operation is performed *immediately* after the death of the woman, the child would not be extracted living. The condition of the fœtus *in utero* is, however, peculiar, and quite distinct from that of a child living by the act of breathing. There may be a limited independent survivorship, and the operation may be performed so late as from a quarter to half an hour after the death of the woman, with the probability of extracting a living child. There is no doubt that it will carry with it the greatest chance of success when performed immediately after the circulation between the woman and the child has ceased. This time will be marked by the cessation of the heart's action in the woman. Lorain extracted a child from the body of a woman, æt. 35, in her eighth pregnancy. She died from eclampsia, and immediately after she drew her last breath, the abdomen was opened and a child at full term was extracted. In about a minute it began to breathe. ('Amer. Jour. Med. Sci.,' 1873, p. 561.) A woman, æt. 25, died of apoplexy in the eighth month of her pregnancy. With the consent of the husband, the Cæsarean operation was performed within *five minutes* after the mother's death, and a male child weighing hardly four pounds was extracted. It was seemingly dead, but by artificial respiration life was restored, and the child is reported to have done well. ('Lancet,' 1870, ii. p. 87.) A woman died from *twenty to thirty minutes* before the performance of the Cæsarean section, which occupied only three minutes. The child was removed living. The pulsation of the cord was scarcely perceptible, and the heart acted very feebly. Artificial means were resorted to, to establish respiration, and in about an hour they were successful. In ten cases of Cæsarean section, there were two recoveries of the mothers; and of six living children recovered, three survived two months. ('Brit. Med. Jour.,' 1877, ii. p. 135.) It has been said that extra-uterine life may be maintained for two hours or more after the death of the mother, but this is doubtful.

3. The child must be born capable of inheriting; therefore, if it be a *monster* which cannot legally take an estate, the husband does not acquire a right of tenancy.

Minority and Majority.—The word *minor* is synonymous with that of *infant* (*infans*), and is applied in law to any one under the age of twenty-one years. The age of a person may render him incompetent to the performance of certain duties. Minors are frequently called upon to act as witnesses in civil and criminal cases. The law has fixed no age for *testimonial* competency, and we have never heard of the question being referred to a medical practitioner. A child is always orally examined by the court, and it is soon rendered apparent by the answers whether the witness possesses a proper knowledge of the nature and obligations of an oath. If not, his or her testimony is not received, except in the case of a rape on a child under thirteen years of age. The competency of a child as a witness does not depend on age, but upon its degree of understanding. In respect to criminal responsibility as affected by age, it was held by Keating, J., in a case (*Reg.* v. *Cowley*, 1860) in which the prisoner, a boy aged *eight* years, was charged with felony, that up to seven years of age the law presumed that a child could not distinguish right from wrong, so as to be legally capable of crime; and evidence was not admissible to prove that he possessed that capacity. After the age of seven and up to fourteen years, although the law presumed a child to be *primâ facie* incapable of crime, this presumption might be rebutted by evidence which showed that he had what was called a mischievous discretion (*doli capax*). In the case referred to, there was no evidence of that sort, and therefore he directed an acquittal. In another case, tried before the same judge in May, 1863 (*Whitby* v. *Hodgson*), an action for trespass and false imprisonment was brought against a man for giving into custody, on a charge of stealing, a boy under *six* years of age. It appeared that the child had stolen some wood; but it was held that at this age, and under *seven* years, a child was in point of law *doli incapax*; hence the defendant was not justified in giving the boy into custody. The jury returned a verdict with damages against him. At the Bedford Sum. Ass., 1873 (*Reg.* v. *Hollis*), a boy of nine was charged with the manslaughter of a boy of about the same age by striking him a blow in the thigh with the iron end of a hoe. This led to death in about three weeks. Cleasby, B., directed the jury that they must be satisfied that there was such a wicked mind in the prisoner at the time of striking the blow, as would rebut the presumption that a child under fourteen years of age is incapable of committing a felony. The jury returned a verdict of not guilty. According to the law, a male at fourteen is considered to be at years of discretion, and he then becomes responsible for his actions; at twenty-one he attains majority, and is at his own disposal, and may alienate his lands, goods, and chattels by deed or will. It is only when this age has been attained that an individual can be sworn to serve on a jury.

A child under fourteen indicted for murder, must be proved to have been conscious of the nature of the act. In the case of *Reg.* v. *Vamplew* (Lincoln Sum. Ass., 1863), a girl under fourteen years of age was convicted of destroying the life of a child by strychnine. It was shown that she was competent to understand the nature of the act. Under fourteen, a male infant is presumed to be incapable, on the ground of incapacity, of committing a rape as a principal in the first degree, or even of committing an assault with intent to perpetrate this crime; but if the boy have a mischievous discretion, he may be convicted as a principal in the second degree. A person may be convicted of an unnatural crime, although the agent be under 14. A female under the age of 13 years is presumed to be incapable of consenting to sexual intercourse.

Boys at or under 14 have been tried and convicted of rape on several occasions. Under the new Criminal Code, it is proposed that there shall henceforth be no presumption of law as to the age at which a boy becomes capable of committing a rape.

A person attains his legal majority, or is completely of age, the first instant of *the day before* the twenty-first anniversary of his birthday; and this mode of calculating age and time is applicable to all other ages before and after twenty-one. This is on the principle that a part of a day is, in a legal point of view, equal to the whole of a day. A few minutes or hours may thus determine the attainment of majority, and, with this, the responsibility of minors for civil contracts or the validity of their wills. By 1 Vict. c. 26, no will made by any person under the age of twenty-one years shall be valid; and as the day of a person's birth is included in the computation of his age, and there being in law no fraction of a day, a valid will may be made at any time on the day before that which is usually considered the twenty-first anniversary of birth.

There is another aspect in which this question of age may be viewed —namely, in reference to the responsibility of accused persons for debts, or alleged criminal acts. In *Reg.* v. *Thornhill* (Stafford Lent Ass., 1865), the prisoner was indicted for a misdemeanour in carnally knowing and abusing one Mary Sambrook, being a girl above the age of 10 and under the age of 12 years. It appeared in evidence that the girl's birthday was on Dec. 5, 1852, and the offence was alleged to have been committed on Dec. 4, 1864. The question then arose whether this girl was at the time under the age of 12 years, so as to bring the offence within the then statute. It was objected by the prisoner's counsel that, as on Dec. 5 as the girl would enter on her 13th year, she had therefore completed her 12th year on Dec. 4, and that the law did not recognize a fraction of a day in such a case, so that she was 12 years old as much on the first hour of that day as on the last; and Pigott, B., so held. The indictment contained counts alleging rape and assault, but, after the cross-examination of the girl, his lordship stopped the case, and the prisoner was acquitted. It is obvious that this principle would now equally apply to charges of felony for the carnal knowledge of children under 13 years of age, as well as to the misdemeanour of taking girls under the age of 16 years from the custody of their parents or of stealing children under the age of 14 years from their parents or guardians. The proof of the exact date of birth sometimes rests with a medical man.

The subject of *plural births* has been regarded as appertaining to medical jurisprudence; but we are not aware that there is any case on record in which the evidence of a medical man has been required respecting it. This is a simple question of primogeniture, which has been generally settled by the aid of depositions or declarations of relations or servants present at the births. Of course, in the absence of eye-witnesses, the question of priority of birth must be a matter of conjecture. It cannot be determined by the size or weight of the child, but it might be determined by the observation of certain marks or deformities in one or more of the children.

Monstrous Births.—The law of England has given no precise definition of what is intended by a *monster*. According to Lord Coke, it is a being 'which hath not the shape of mankind; such a being cannot be heir to, or inherit land, although brought forth within marriage.' A mere deformity in any part of the body, such as supernumerary fingers or toes, twisted or deformed limbs, will not constitute a monster in law, so far as the succession to property is considered, provided the being still have '*human shape.*' From Lord Coke's description, it is obvious that the law will be guided in its decision by the description of the monstrous birth given by a medical witness. It would not rest with a witness to say whether the being was or was not a monster—the court would draw its inference from the description given by him. Various classifications of monsters have been made, but these are of no assistance to a medical jurist, because each case must be decided by the peculiarities attending it; and his duty will not be to state the class and order of the monster, but simply in what respect it differs in shape and external appearance from a normal child. But the question here presents itself—What is a normal child, or indeed 'child,' in a legal sense? On this point conflicting decisions have been given by different judges (p. 536, *ante*). All will agree that a blighted fœtus or a mole is not a child, but a difference has arisen on the question whether the *partus* should, in addition to having human shape, have reached a uterine age at which it could continue to live, *i.e.* that it should have viability. (See Concealment of Birth, p. 533.) A correct definition of a normal child, therefore, is still a desideratum in law. Although a monster may not survive its birth more than a few seconds, yet if it be legally pronounced from the medical evidence to have human shape, it may transmit an estate to its heirs-at-law, as in the case of normally formed children.

Malpositions, transpositions, or defects of the internal organs of any of the cavities do not form monstrous births within the meaning of the English law. The legal question relates only to *external* shape, not to *internal* conformation. It is well known that many internally malformed persons live to a great age; and it is not until after death that malpositions and defects of this kind are discovered. In French jurisprudence the case appears to be different; if the malposition or defect was such as to become a cause of death soon after birth, the child would be pronounced not '*viable*,' and therefore incapable of acquiring civil rights. Some medical jurists have discussed the question of '*viability*' in new-born children, *i.e.* their healthy organization with a capacity to continue to live, as if it were part of the jurisprudence of this country; but there are no facts which bear out this view. The English law does not regard *internal* monstrosity as forming a bar to civil rights; and the cases decided hitherto show clearly that the simple question in English jurisprudence is, not whether a child (*partus*) is or is not '*viable*,' but whether it has manifested any distinct sign of life after it was entirely born. The French law is much more complex, and throws a much greater degree of responsibility on French medical jurists.

No person is legally justified in destroying a monster at birth (p. 599, *ante*).

LEGITIMACY.

CHAPTER 56.

PRESUMPTION OF LEGITIMACY.—NATURAL PERIOD OF GESTATION.—DURATION OF PREGNANCY FROM ONE INTERCOURSE.—PREMATURE BIRTHS.—SHORT PERIODS OF GESTATION.—VIABILITY.—EARLIEST PERIOD AT WHICH A CHILD MAY BE BORN LIVING.—EVIDENCE FROM THE STATE OF THE CHILD.—PROTRACTED BIRTHS.—THE PERIOD OF GESTATION NOT FIXED BY LAW.

Legal Presumption of Legitimacy.—Every child born either in lawful matrimony, or within a period after the death of the husband in accordance with the natural duration of gestation, is considered by the English law to be the child of the husband, unless the contrary be made clearly to appear by medical or moral evidence, or by both combined. It is only in reference to *medical* evidence that the subject of legitimacy can here be considered; but it is extremely rare to find a case of this kind determined by medical evidence alone. There are generally circumstances which show that a child whose legitimacy is disputed is the offspring of adultery, while the *medical* facts may be perfectly reconcilable with the supposition that the claimant is the child of the husband. These cases, therefore, have been repeatedly decided from *moral* evidence alone—the medical evidence respecting the period of gestation or physical capacity in the parties leaving the matter in doubt. The present state of the English law on this subject appears to be this. A child born during marriage is deemed illegitimate when, by good medical or other evidence, it is proved that it was *impossible* for the husband to have been the father—whether from his being under the age of puberty, from his labouring under physical incapacity as a result of age or natural infirmity, or from the length of time which may have elapsed since he could have had intercourse, whether by reason of absence or death. When the question turns upon any of these conditions, medical science is required for its solution, and on these occasions skilled experts are usually selected by the litigants. With proof of non-access of the husband or immorality on the part of the mother, so important on these occasions, a medical witness is not in the least concerned. In cases of contested legitimacy, the English law does not regard the date of *conception*, which cannot be fixed, but the date of *birth*, which can be fixed. Medical evidence may relate, first, to the actual length of the period of gestation,—this may be in a given case so short or so long as to render it medically impossible that the husband could be the father; second, there may be physical incapacity in the husband to procreate,—he may be too old or too young, or he may labour under some physical defect rendering it impossible that he should be the father; third, there may be sterility or incapacity in the wife, rendering it impossible that the child should be the offspring of a particular woman,—in other words, the claimant may be a supposititious child.

Natural Period of Gestation. Duration from One Intercourse.—The first point to be considered is—What is the natural period of gestation, and whether this is a fixed or variable term. According to the testimony of experienced accouchers, the average duration of gestation in the human female is comprised between the *thirty-eighth and fortieth weeks* after conception. Numerous facts show that the greater number of children are naturally born between these two periods. Out of 186 cases reported by Murphy, the greater number of deliveries took place on the 285th day ('Obst. Rep.,' 1844); but his opinion is that 301 days may be taken as the average *limit* of gestation. ('Lancet,' 1844, ii. p. 284.) Blundell considered that the average period was 274 days. Simpson (*Bromwich* v. *Waters*, Chester Lent Ass., 1863), 277 days, *i.e.* nine calendar months and a week; and other accoucheurs of repute have fixed upon 280 days. Among 500 cases observed by Reid, there were 283 in which the period of gestation was within 280 days, and 217 cases in which it went beyond this period. Duncan found, in a group of forty-six cases, that 275 days is the average interval between that which he terms 'insemination' (intercourse) and parturition. The largest number of cases on any particular day was seven on the 274th day. ('Edin. Month. Jour.,' 1854, vol. ix. p. 230.) The most common cause of this variation in time is that the usual mode of calculation, by reference to the suppression of the menstrual discharge, even in a healthy woman, may lead to a possible error of two, three, or even four weeks, since there is no sign whereby, in the majority of women, the actual time of *conception* can be determined. Some have been able to determine by peculiar sensations, the time at which they have conceived; but, as a general rule, this must be a matter of pure conjecture when they are living in connubial intercourse.

On the other hand, accidental and isolated cases have clearly proved that a great difference naturally exists among women with respect to the period of gestation; and it is probable that in no two is it necessarily the same. When there has been only *one* intercourse, the duration of pregnancy may be certainly calculated without reference to any changes in the female constitution; for the date of conception, within certain limits to be presently mentioned, would be fixed. Observations of this kind have shown that women have differed from each other; and in several instances the time has exceeded or fallen short of the period of forty weeks, which has been usually set down as the legal limit of natural gestation. In three cases of single intercourse known to the late Rigby, labour came on in 260, 264, and 276 days, making a difference of sixteen days. ('Med. Times,' 1846, i. p. 471.) In three other instances which were communicated by Merriman, labour commenced at 281, 283, and 286 days respectively after one intercourse; and in a case which occurred to Reid, the labour did not commence until after the lapse of 293 days from a single intercourse. ('Lancet,' 1850, ii. p. 79.) In another case accurately observed the gestation lasted 281 days. Menstruation had ceased on the 16th Sept., intercourse took place on the 20th, quickening occurred on the 23rd Jan., and a full-grown male child was born on the 28th June following. In two cases, the women were delivered respectively in 249 and 260 days after a single intercourse. In a third, in which pregnancy was the result of a rape, there was an interval of 261 days between intercourse and delivery. Hence it will be perceived that in well-observed cases, where there could be no motive for misstatement, and in which the characters of the women, some of whom were married and had already borne children, were beyond the reach of suspicion, a difference of not less than *thirty-three days* has been observed to occur, *i.e.* between the earliest case reported by Rigby, and the latest reported by Reid. This is worthy of remark, because in one case (*Luscombe* v. *Prettyjohn*) it was legally held that 299 days, only six days longer than in Reid's observation, was an *impossible* period for human gestation. In addition to the above facts, showing the variability of the period after a single intercourse, the following may be cited. Macilvain has reported a case of gestation which he thinks must have extended to 296 or possibly to 299 days. ('Amer. Jour. Med. Sci.,' 1848, p. 247.) We are indebted to Oldham for nine cases, which have fallen under his observation, in which the duration of pregnancy from a single intercourse was accurately observed:—

Case.	Days.	Case.	Days.
1	266	6	281
2	268	7	283
3	271	8	284
4	280	9	285
5	280		

Nos. 4, 5, and 6 represent the periods of gestation in the same woman at different times.

Idelson, a recent female medical authority, made observations on the durations of pregnancy in 4370 cases. The usual duration was 279 days. ('Petersburg. Med. Wochenschr.,' April 28, 1881.)

Lockwood published the following as the result of his experience.

The actual duration of the term of gestation in the human subject, *i.e.* the interval between intercourse and delivery, was ascertained by him in four cases: No. 1, aged 19, duration 272 days (first confinement); No. 2, aged 30 (first confinement), duration 276 days; No. 3, aged 17, duration 270 days; No. 4, aged 44 (seventh confinement), duration 284 days, the child weighing fourteen pounds. ('Brit. Amer. Jour.,' Dec. 1847, p. 214.) Devilliers also published the particulars of nine cases, in which the interval from a single intercourse was accurately determined. Delivery took place at the following periods: 229, 246, 257, 267, 301, 276–281, 278–283, 270, and 266–272 days, making an extreme difference of 49 days in the earliest and the latest periods between intercourse and delivery. ('Lond. Med. Gaz.,' 1848, p. 524.) Ahlfeld made observations on 425 women, whose children seemed mature, and, reckoning from the day of conception, he found that the average duration of gestation was 269·9 days. Out of thirty cases of single or well-defined coitus collected by him, gestation varied from 233 days to one case of 313 days. The average of all was 269·17 days, which corresponds closely with the period obtained by other modes of observation. ('Amer. Jour. Med. Sci.,' 1870, p. 566.) Heckers' tables gave an average of 273·5 days. According to Stadtfeldt, the mean duration in sixty-five pregnancies observed by him was 271·8 days, and the extent of variation was from 250 to 293 days. ('Brit. Med. Jour.,' 1877, ii. p. 599.) Strathy reports a case (ibid., 1876, i. p. 505) in which a married woman was delivered of a child weighing about five pounds, 298 days after the last intercourse with her husband. A long period of gestation, 308 days accurately recorded, is based upon the observation of Hewett. The duration was ascertained by the sudden death of the husband, and rests obviously upon the statement of the wife. (Guy and Ferrier, 'Princ. of For. Med.,' 5th edit., p. 138.)

There is reason to believe that the *date of conception* after a single intercourse varies in different women and in the same woman at different times. It is customary for physiologists to date conception from intercourse; but a variable interval may elapse, according to the situation of the ovum at the time. It has also been supposed that women conceive more readily at some periods than at others, and that intercourse had within eight to twelve days from the cessation of the menstrual discharge is more favourable to conception than at any other period. Oldham met with a case in which impregnation took place twelve days after menstruation; and he states that he has known it to occur at the respective times of ten days, twelve days, and even twenty-one days after the monthly period; and he knows of no fact to disprove the opinion that the human female is susceptible of impregnation at any time between her monthly periods. According to Duncan, a single insemination at any period of the interval between two menstrual periods may result in fecundation. ('Edin. Month. Jour.,' 1854, vol. ix. p. 233.)

The experience of Oldham is confirmed by that of Reid. This authority admits that impregnation is more likely to occur immediately after the termination of a menstrual period than at any time during the interval. The next most likely period is immediately previous to the occurrence of menstruation, and the probability of conception becomes slighter as the time is more distant from this epoch; but there is no period in the menstrual interval at which impregnation may not occur. ('Lancet,' 1853, ii. p. 205.) According to Raciborski, from observations made on one hundred women, no more than six or seven had become impregnated at the mid-term from the menstrual periods. In several cases of single intercourse, the dates being certain, conception took place twelve and fourteen days after menstruation. It may be therefore fairly taken as a fact, irrespective of any theories of ovulation, that a woman may conceive from intercourse had at the inter-menstrual period (mid-period), although, in a given number of instances, it is probable that the conceptions would be more numerous within six or seven days after the cessation of the menses than at any other time.

In this case it is assumed that intercourse and conception are synchronous, but the date of *conception* is not fixed by the date of *intercourse.* The time occupied by the descent of the ovum along the Fallopian tube varies, while the time required for the passage of the male fluid to meet the ovum is also subject to variation. The investigations of Bischoff and Valentin show that the spermatozoa may retain their movements, and probably their fecundating power, for so long a period as *seven days* within the body of a woman. Fecundation cannot result unless the matured ovum meets these bodies in an active or living condition; and conception may be regarded, in the language of Meigs, as the fixation of a fecundated ovum upon the living surface of the woman. Conception may therefore take place either in a few hours or, according to Valentin's observations, at so long a period as seven days, after intercourse. But this does not satisfactorily explain such extreme differences as were observed in the cases of Rigby and Reid (thirty-three days), or in those of Devilliers (forty-nine days)—*ante*, pp. 640, 641. We must, therefore, be prepared to admit, either that conception may in some cases be delayed for so long a period as from five to seven weeks after intercourse, or that there may be a difference of from five to seven weeks in the duration of pregnancy. Whatever may be the explanation adopted, it is obvious that, in a medico-legal view, the only conclusion at which we can arrive is that the period of gestation in women is *not*, as it was formerly supposed to be, a fixed and invariable term.

Mistakes have arisen in the calculation of the period by the use of the word 'month'—some intending by this a *lunar* and others a *calendar* month. Nine lunar months would be equal to 252 days, while the average of nine calendar months would be 274 days—the latter period varying according to the particular months of the year over which the pregnancy might extend. To prevent mistakes, or that misunderstanding of evidence which has so frequently arisen, it is advisable that medical witnesses should always express the period of gestation in weeks or days, concerning which there can be no misunderstanding; and adopt the plan of always commencing the calculation from the period of the last cessation of the menses, rather than from two weeks later. The latter rule is often followed, and this discrepancy is another cause of confusion.

Premature Births. Short Periods of Gestation.—From the preceding remarks, we may regard all births before the thirty-eighth week as premature, and all those which occur after the fortieth week as protracted cases; and one great point for a medical witness to determine is whether the external characters presented by a child correspond to those which it should present, supposing it to be legitimately born. When the birth is premature, this sort of corroborative evidence may be sometimes obtained; because, assuming that there has been no access between the parties before marriage, children born at the fifth or sixth month after marriage cannot, if the offspring of the husband, present the characters of those born at the full period. It is not so with protracted births, for children are not more developed in protracted cases than they are in those which occur at the usual period. This would lead to the inference that, when a child has reached a certain stage of development, it ceases to grow—a view which is borne out by the observations of Rüttel. (Henke's 'Zeitschrift,' 1844, p. 247.) He observed that the size of a child did not increase in proportion to the length of gestation. In protracted human and animal gestation, the offspring is not remarkable for size and weight. Thus robust mothers have had small children, and small mothers strong and sometimes unusually large children. Murphy states that he met with a fully developed child which was born after a gestation of only 251 days. ('Lancet,' 1844, ii. p. 284.) For an account of the characters presented by children at different uterine ages, see Infanticide (p. 558, *ante*).

Development of the Child.—In judging from marks of development on the body of a child as a test of uterine age, we must make full allowance for the exceptions to which they are liable. The nearer the supposed premature delivery approaches to the full period of gestation, the more difficult will be the formation of an opinion. Although the characters of a seven months' child, as a general rule, are usually well marked, and may be known by common observation, it is not possible to distinguish with absolute certainty a child born at the eighth from one born at the ninth month. Burns observes that gestation may be completed, and the child perfected to its natural size, a week or two sooner than the end of the ninth month; and other accoucheurs corroborate this view. (Murphy, in 'Lancet,' 1844, ii. p. 284.)

When, however, the facts are such that to be the offspring of the husband it must be a six months' child, and it is born mature, there can be no reason to doubt that it is illegitimate. (*Eager* v. *Grimwood*, Exch. Sittings, Jan. 7, 1847.) But the fact that a child born at nine months is small, and resembles in size and weight a seven or eight months' child, cannot be taken as a medical proof of illegitimacy. Children born at the full period vary considerably in size and weight; yet, although small, there is commonly about them an appearance of *development*, which is especially apparent in the features. If there should be a general want of development in the body, and if certain fœtal peculiarities remain—as, for example, the membranæ pupillares, or, in the male, the testes do not occupy the scrotum—these facts lead to a strong presumption that the child has not reached the full period. On the other hand, when a child is born with the full signs of maturity about it, at or under seven months from possible access of the husband, there is an equally strong presumption that it is illegitimate. The great progressive stage of development is during the last two months of gestation—the changes which the fœtus undergoes are greater and more marked at this than at any other time. The general opinion is that an eight months' child is not with any certainty to be distinguished from one born at the ninth month. If the body of a child is large and fully developed, it would be considered to have been born at the full period of gestation, and any opinion which had led to the supposition that it was a seven months' child would be attributed to some mistake in the calculation. Beck states it as barely possible that a child born at seven months may *occasionally* be of such a size as to be considered mature, yet he qualifies this statement by the remark that the assertion is most frequently made by those whose character is in danger of being destroyed. The important medical question is, however—Has a really seven months' child ever been born so developed as to be mistaken by an experienced person for one that was mature? He adduces no case of this kind in support of his opinion. There can be no doubt of the correctness of this statement, that a *mature* child, born *before* seven full months after intercourse, ought to be considered illegitimate: but it would be difficult to maintain this proposition consistently with the above admission.

In *Bromwich* v. *Waters* (Chester Lent Ass., 1862), the question of premature development arose incidentally upon an alleged gestation of 259 days. It was stated that intercourse had taken place upon Nov. 9, 1861, and a child was born on July 26, 1862—a period of 259 days, or thirty-seven weeks. The child had the appearance of a mature child. The counsel for the defendant admitted that a child born at this period, *i.e.* three weeks before maturity, might be as large as one born at the ninth month, but he denied that it would be so perfectly developed in all its parts. When the question was put to Simpson, he said that full size was generally combined with full development; and he further stated that it was against all the laws of nature that children should be born full grown even a fortnight before the usual term of gestation, which he fixed at nine calendar months and a week. According to this view, if there had been intercourse on Nov. 9, 1861, the day of probable delivery would be a week after the 9th of the following August, *i.e.* on Aug. 16, 1862. Hence, as the child was actually born in a *mature state* on July 26, this was three weeks before the usual term; and therefore, in his opinion, impregnation from some other person had probably taken place three weeks earlier than the period assigned by the woman (Whalley). Simpson considered it to be as rare that a child should be born full grown three weeks before the usual period, as that a man should attain one hundred years of age. ('Rep. of the Trial of *Bromwich* v. *Waters*,' 1863, p. 33.) There are not many medical witnesses, however, who would venture to affirm that in the last three weeks of gestation there are such marked changes in the body of a child as to render this difference in time always perceptible, or who would venture to bastardize a child or convict a woman of adultery because, when born at the 259th day after intercourse, the child had about it the usual appearances of maturity. This would be equal to affirming that variations in size might take place at the ninth, but not at the eighth month of gestation. But facts are adverse to the theory. Rüttel has met with several instances in which women have been delivered *two* and even *three weeks* before the expiration of the ordinary term (280 days), and the children were as perfectly developed, to all appearance, as other children which had been born at the full period; at any rate, they could not be distinguished from them by competent observers.

In another part of this work (Infanticide, p. 560, *ante*), some cases are related which prove that, at the ninth month, children are occasionally born of a size and weight greatly exceeding the average. Thus a nine months' child has been born weighing eighteen pounds and measuring thirty-two inches, whereas the usual weight is from six to seven pounds, and the length eighteen inches. In such an exceptional case, there is reason to believe that, had the child come into the world at the seventh month, it would have appeared to the accoucheur to have reached the full term. As it is impossible to say when such an exception is likely to occur, and a lawyer is always entitled to take advantage of either extreme, it follows that, in any case in which this question arises, a witness will be bound to admit that a seven months' child may be born of the average size and weight of a nine months' child, or to give some valid reason for the fact that great variations in size and weight may occur at the ninth, but never at or about the seventh or eighth month of gestation. He must also be prepared to affirm from facts within his knowledge that, in these extreme cases, the doubling of the weight and length of the child is not progressive, but that it suddenly takes place at or near the ninth month. If the child is a male, and the testicles are found in the scrotum, there is every reason to believe that it has passed the seventh and even the eighth month of uterine life. (See Infanticide, p. 559, *ante*.) The differences of opinion among obstetric experts in reference to this question appear to admit of explanation. All will agree that, as a general rule, a seven months' child might be distinguished from a nine months' child, unless the latter was a twin; but at the same time, it must be admitted that, if variations in development take place at the full term, there is nothing to prevent such variations from occurring at the seventh and eighth months of gestation. Rigby said that he had often met with instances of well-developed children born within *seven months* of marriage, but only with the first child. The date of marriage must not, however, always be taken as the date of conception. ('Obst. Trans.,' 1875, p. 227.) Hicks has seen a child born seven months after marriage as large as at the full term; but, as he suggests, this child might really have been begotten so as to be born at the full term. In order to determine this point by unexceptional facts, it would be necessary to collect a series of cases of impregnation from one intercourse in which the children were born seven months after such intercourse, and were proved to have had the average size and weight of mature children.

Earliest Period at which a Child may be born living. Viability.—The fact that a child has had the strength to survive its birth for a certain period has been supposed to furnish additional evidence of maturity; for it is well known that, under a certain age, children are not born living, or if living they speedily die. Therefore it has been argued, if a child born at the fifth or sixth month after the first cohabitation be born living or survive, this should, *ipso facto*, be taken as a proof of its illegitimacy. According to the English law, it is not necessary that a child, when born, should be capable of living, or *viable*, in order that it should take its civil rights. Thus it may be born at an early period of gestation,—it may be immature, and not likely to survive; or, again, it may be born at the full period of gestation, but it may be obviously labouring under some defective organization, or some mortal disease, which must necessarily cause its death within a short time after its birth. Fortunately, these points are of no importance in relation to the right of inheritance; an English medical jurist has only to prove that there was some well-marked physiological sign of *life* after birth. Whether the child was mature or immature, diseased or healthy, is a matter which does not at all enter into the investigation. In this respect our law appears to be more simple and just than that which prevails in France. By Art. 725 of the Code Napoléon, no child that is born alive can inherit unless it is born, as the law terms it, *viable*. The meaning of this word is not defined by the law itself, and there are probably no two lawyers or physicians in that country who place upon it the same interpretation. The French law seems to intend by viability in a new-born child, that it should have breathed and be capable of living out of the womb of its mother and independently of her; also that it should be capable of living for a longer or shorter period after its birth. It would be difficult for any system of jurisprudence to lay down a more vague or incorrect principle than this.

The question, therefore, to be considered is—What is the *earliest period* of uterine life at which a healthily formed child can be born living, and with a capacity to live after its birth and to attain maturity? It is universally admitted that children born at the seventh month of gestation are capable of living, although they are more delicate, and in general require greater care and attention to preserve them than children born at the ninth month; the chances are, however, very much against their surviving. It was the opinion of W. Hunter, and it is one in which most modern authorities concur, that few children born before *seven calendar months* (or 210 days) are capable of living to manhood. They may be born alive at any period between the sixth and seventh months; or even, in some instances, earlier than the sixth; but this is rare, and, if born living, they commonly die soon after birth. There is one case on record of a child having been born living so early as the *fourth month* of gestation ('Brit. and For. Med. Rev.,' vol. ii. p. 236); and another in which a woman aborted at the fourth month and a half of pregnancy. Maisonneuve saw the woman two hours after delivery: he then found the fœtus in its membranes, and, on laying these open, to his surprise it was still moving. He applied warmth, and succeeded in partially restoring it; for a few minutes the respiratory movements were performed with regularity, but in spite of the establishment of respiration, the child died about six hours after its birth. ('Lond. Med. Gaz.,' vol. xxxix. p. 97.) Ellis brought before the Obstetrical Society a fœtus born five months and ten days dating from the last menstrual period (5½ months' gestation). Immediately the child was born, it cried so loudly that it was heard downstairs, and continued at intervals to cry as loudly as a full-grown infant. It could not be made warm. It passed meconium, but no urine. It swallowed without trouble. The eyelids were closed. Its weight was one pound and a quarter, its length was eleven inches. It lived forty-four hours. Other cases of a similar kind have been elsewhere described (p. 631). It was said that this child was not *viable*, though it had potential life. ('Brit. Med. Jour.,' 1874, i. p. 547.) In two instances of abortion about the *fifth month*, Davies noticed that the fœtus showed signs of life after its birth, by moving its limbs ('Lond. Med. Gaz.,' vol. xl. p. 1022); and in the following case a child born at the *fifth* month survived upwards of twelve hours. A woman in her second pregnancy, and in the 147th day of gestation, had severe flooding, with rupture of the membranes. Labour occurred on the following night, when a small but well-formed fœtus was expelled, giving no other indication of life than a feeble action of the heart, and a strong pulsation in the cord. It was resuscitated, and *cried* as strongly as a child born at the full period of pregnancy. It weighed less than two pounds, and was twelve inches in length. It swallowed some nourishment, but died about twelve hours after birth. The membranæ pupillares were entire, the testicles had not descended, the head was well covered with hair. The length and weight, as well as the presence of hair, indicated a fœtus between the sixth and seventh months; but, as it is asserted that the period of gestation is accurately given, this must be regarded as an extraordinary instance of premature development. There was clearly nothing in the organization of this child to have prevented its growing to the age of maturity; in other words, it was *viable*. ('Med.-Chir. Rev.,' 1844, p. 266.) In 1865, Carter communicated to the author the particulars of a case in which a child was born living at the *fifth month* of gestation. It cried slightly when it was born, and during the half-hour that it was unsevered from its mother, it made frequent efforts to breathe. It was perfectly formed. It was about one foot in length, and its weight was fully one pound and a quarter. It died soon after it was born. Moore reported a case of a child born living at the fifth month. ('Lancet,' 1865, ii. p. 535.)

A case is reported in which a child born at five months and a half survived its birth between three and four hours ('Lond. Med. Gaz.,' vol. xix. p. 165); and on a trial for child-murder (*Reg.* v. *West*, Nottingham Lent Ass., 1848), a midwife was indicted for causing the death of a child by bringing about the premature delivery of the mother, when she was between the fifth and sixth months of her pregnancy. The child in this instance lived five hours after its birth. Capuron mentions a case in which a child was born at the sixth month and a half of pregnancy, and at the date of the report it was two years old, and enjoyed excellent health. In another instance a child was born at the same period, and lived to the age of ten years. ('Méd. Lég. des Acc.,' pp. 162, 208.) Capuron considers that a child born at the 180th day, or at the sixth month after conception, may be sufficiently mature to live, *i.e.* that there would be no reason to presume it was illegitimate merely because it survived its premature birth. On the other hand, if born before the sixth month with sufficient maturity to live, this fact, although by no means a proof, affords, in his opinion, a strong presumption of its illegitimacy. Of eight cases of children born living (by abortion) at the sixth month, Whitehead states that seven perished within six hours after birth, and one only attained to the age of ten days. ('On Abortion,' p. 249.)

Rüttel, who has examined this subject with great care, states, as the result of his experience, that he attended a married woman, who was afterwards delivered of a living child in the *fifth month* of her pregnancy; the child survived its birth for twenty-four hours. He delivered another woman of twins in the *sixth month* of her pregnancy: one was dead, and the other continued alive for three hours, its life being indicated only by the visible pulsation of the heart, but there was no perceptible breathing. This fact strongly corroborates the remarks made elsewhere, as to life without active respiration (Infanticide, p. 574, *ante*); it has also an immediate bearing on the proof of life in reference to tenancy by courtesy (p. 630, *ante*). In another instance of the birth of male twins, at the *sixth month*, each weighed three pounds. Rüttel saw them a year after their birth, and they were then two healthy strong children. (Henke's 'Zeitschrift der S. A.,' 1844, p. 241.) Barker met with a case in which a female child was born on the 158th day of gestation, or twenty-two weeks and four days after intercourse. The size and weight of the child corresponded with the period at which it was born: it weighed one pound, and was eleven inches in length. It had only rudimentary nails, and very little hair on the back of the head; the eyelids were closed, and remained closed until the second day; the nails were hardly visible; the skin was shrivelled. The child did not suck properly until after the lapse of a month, and she did not walk until she was nineteen months old. When born, the child was wrapped up and placed in a box before the fire. Three years and a half afterwards, the child was in a thriving state and healthy, but of small make, weighing twenty-nine pounds and a half. ('Med. Times,' 1850, ii. pp. 259, 392.) In a case which occurred to Outrepont (Henke's 'Zeitschrift,' vol. vi.), there was the strongest reason to believe that gestation could not have exceeded twenty-seven weeks. A male child weighed, when born, one pound and a half, and measured thirteen inches and a half. The skin was covered with down, and much wrinkled, the limbs were small, the nails appeared like white folds of skin, and the testicles had not descended. It breathed as soon as it was born, and by great care its life was preserved. It is singular that its development was very slow until it had reached a period which would have corresponded to the forty-second week of gestation. Outrepont saw the child when he had attained the age of eleven years, and then he appeared to be of the size of a boy of eight years. The only remarkable point about this case is the length of time which the child lived. In a case quoted in the 'Lancet' (1851, ii. p. 177), a child born at six months and ten days was thriving satisfactorily when four months old. (See also 'Med. Times,' 1850, i. p. 129.)

Hence it may be considered as established that children born at the seventh, and even at or about the sixth month, may be reared, and that the fact of their surviving for months or years cannot be taken as a proof of illegitimacy. In forming our judgment on these occasions, we are bound to look less at the period at which a child is born than at the marks of development about the body. The case reported by Smythe (p. 550, *ante*) is corroborative of this view. Bonnar has recently published a tabulated view of 112 cases of premature births of living children—the dates of gestation extending from the 120th to the 210th day. Among these cases, 35 children died within the first twenty-four hours; 13 more before the completion of one week; 1 in six weeks; 4 in four months. The following lived, or were living at the date of the report:—1, seven months and a half; 8, from one to two years; 1, three years and a half; 5, from ten to fifteen years; 6, to adult age; 5 lived, but it is not stated how long. ('Critical Inquiry regarding Superfœtation,' 1865, p. 13.)

Protracted Births. Long Periods of Gestation.—The questions connected with retarded gestation have given rise to considerable discussion in legal medicine. That gestation may be retarded or protracted beyond the fortieth week is now not disputed by any obstetric writer of reputation. Some accoucheurs have denied it, because they have not met with such cases; but the medico-legal relations of such questions as these do not depend upon the solitary experience of practitioners. It is only by the accumulation of well-ascertained facts from all authentic sources that medical knowledge can be made available for the purposes of the law; otherwise, owing to the mere accident of a witness not having met with any exceptional instance, a court may be entirely misled in its judgment by trusting to his opinion. It is the more important to attend to this, because most of the cases involving questions, either of contested legitimacy or of the chastity of women, turn upon protracted rather than upon premature delivery.

In standard works on Midwifery will be found authentic reports of cases in which gestation continued to the forty-first, forty-second, forty-third, and even to the forty-fourth week. Murphy regarded 301 days, or forty-three weeks, as the average limit of gestation. ('Obst. Rep.,' p. 4.) Lee met with a case in which he had no doubt that the pregnancy lasted 287 days; the labour did not take place until forty-one weeks after the departure of the husband of the lady for the West Indies. ('Lond. Med. Gaz.,' vol. xxxi. p. 917.) W. Hunter met with two instances in which gestation was protracted until the forty-second week. Montgomery met with a case in which delivery did not ensue until between the forty-second and forty-fourth weeks. ('Lond. Med. Gaz.,' vol. xix. p. 646.) Merriman has published a table on the subject of protracted gestation, on which the most experienced accoucheurs have been in the habit of relying. Of 114 pregnancies calculated by him from the last day at which the women menstruated, and in which the children appeared to be mature, the following were the periods:—

In the 37th week . .	3	In the 41st week . .	22
„ 38th „ . .	13	„ 42nd „ . .	15
„ 39th „ . .	14	„ 43rd „ . .	10
„ 40th „ . .	33	„ 44th „ . .	4

Another well-marked case, occurring precisely forty-four weeks after the cessation of the menses, was communicated to the author by Merriman.

From these results, Merriman considers that, in the greater number of women, gestation is completed in the fortieth week from the cessation of the menses, and next to this period, in the forty-first. In the evidence given by him in the *Gardner Peerage* case before the House of Lords in 1825, the case of longest protraction on which he was able to rely was that of a married woman, who was in the habit of calculating from the last day on which her monthly period ceased. This lady was delivered 309 days, or forty-four weeks and one day, from the time at which she supposed that she had conceived. In another case mentioned by the witness the period was 303 days, or forty-three weeks and two days from the termination of the last monthly period. It was objected to this evidence that it was impossible to fix the exact date of conception, and, as the female might have really conceived only a day or two before the expected return of menstruation, twenty-eight days (or four weeks) should be deducted from the periods assigned by the witness. Admitting the validity of this objection—and the fact upon which it is based is indisputable—it followed that the longest protracted case observed by Merriman might have really been only a case of ordinary gestation extending to forty weeks and one day. An objection of this kind may, of course, be successfully urged in law to any inference from a calculation so made, and it was thus that in the *Gardner Peerage* case the medical evidence failed to render it certain that gestation might be so protracted as to support the legitimacy of the claimant; namely, to 311 days, or forty-four weeks and three days. Hence, in considering this question, it is necessary to make full allowance for such a cause of error; and, in calculating the pregnancy from the last day of the last menstrual period, we should deduct the interval of menstruation, if known, and at least twenty-eight days if unknown. In these cases of contested legitimacy, the offspring is commonly the result of a *single* intercourse, hence the date of conception is fixed within limits already described (p. 641); and a comparison can be instituted only between the period of gestation thence deduced, and the periods taken in other cases which are equally free from error.

A well-marked case of gestation passing beyond what is commonly set down as the average period, was communicated to the author by Howell. This occurred in a healthy woman, aged 30, who had borne three children, the youngest being 4 years old. She had menstruated with regularity up to the third week in June; the menses then stopped without any apparent cause. Her delivery took place 323 days after their last appearance. Allowing that impregnation occurred at the intermenstrual period, this would make the gestation 309 days; or, assuming that impregnation did not occur until twenty-eight days from the date of the last menstruation, this would make the period 295 days, or forty-two weeks and one day.

A case is reported by Power ('Human Pregnancy'), in which gestation is said to have extended to 325 days. Chattaway communicated to the author the following instance of protracted gestation. A healthy woman, æt. 36, applied to him to attend her in her confinement, which she expected to take place in Sept. 1856. The menses appeared for the last time in Dec. 1855, and she quickened in the beginning of April, 1856. About the middle of Sept. (*i.e.* on the 283rd day, dating from the last menstruation), Chattaway was summoned to attend her, and he found her labouring under severe false pains; there was also a discharge of mucus tinged with blood. The case went on until Nov. 19th, 1856, when the patient was delivered of a female child of the average size. It would thus appear, according to the ordinary mode of calculation, that, deducting twenty-eight days from the last appearance of the menses, gestation was protracted in this instance to 330 days, or forty-seven weeks and one day. This, of course, is open to the suggestion that the menses had ceased from some accidental cause, and that pregnancy had taken place some weeks subsequently. It is known, in fact, that a woman may, exceptionally, menstruate even more than once after conception. In reference to this objection, it may be observed that few women have such unusually protracted pregnancies. Then, again, all practitioners may not have met with protracted cases; but the fact being clearly ascertained in one case, it is unnecessary to search for more, unless we doubt the credibility of reporters well qualified to observe, and who could have had no conceivable motive to misrepresent the facts which came before them. The advocates of a fixed and limitable period differ from each other by a space of at least ten or twelve days, and each must either take his own experience for the final decision of this question, or must allow that men of equal powers of observation with themselves have met with exceptional instances.

Protracted cases of gestation are always open to the objection that the menstrual function may have been suspended from some hidden morbid cause, one or two months before the actual date of conception, and that there may have been some error in the calculation by which the period has been determined. If, however, the objection is admitted under these circumstances, it would be only equally just to admit that in any given case the ordinary and so-called fixed period, also calculated from the cessation of menstruation, is based on a fallacy. The menstrual function may have accidentally ceased, or continued for several intervals after conception, and thus a corresponding change should be made in fixing the ordinary period of gestation. This view of the question implies that no reliance can be placed on the date of the cessation of the menses as evidence of the actual duration of pregnancy, whether natural, premature, or protracted. But Hicks met with a case in which the pregnancy of a woman *appeared* to be protracted to between twelve and thirteen months. There was every reason to believe that this woman became pregnant during the absence of the menses, and that these had been suspended for some time before intercourse took place. This is no doubt the explanation of a large number of cases of alleged protracted gestation. We have no right, in alleged protracted cases, to refer the suppression to disease, for the sake of shortening the period, when in ordinary cases we do not refer its continuance to disease, because this would tend to lengthen it; if rejected, it would be in the highest degree unjust not to give to a claimant the beneficial presumption of his having been born legitimately, when the cases adduced in evidence against his claim are actually based upon a precisely similar mode of calculation. It is, however, difficult to admit that all the protracted cases recorded by different observers have depended upon mistakes being made in the calculation of the period, since this calculation is based on the same principles as those adopted in cases of ordinary pregnancy. Hence, if there is a mistake in the one case, there would be in the other; if an error in the exception, there would be an error in the rule. Either the average term of pregnancy is wrongly calculated by most accoucheurs at the thirty-eighth or fortieth week, or it is rightly calculated to extend occasionally to the forty-fourth, or, admitting these protracted cases, to the *forty-sixth* week. But, even setting aside the obvious answer to an objection of this nature, some of the protracted cases observed were instances of impregnation from a single intercourse; and, making due allowance for the interval for conception, the general inference would not be affected, and no fallacy could have arisen in these cases of protraction from mistakes dependent on the cessation of menstruation.

Reid's conclusions, derived from numerous facts and cases, represent the views of an experienced observer on this much-disputed question. They are—'1. The duration of pregnancy is not altogether a fixed period; it varies somewhat in the human female as it does in the lower orders of animals. 2. This deviation, however, is not to any great extent; the only *certain* data of calculation are those dependent on the *known time of conception* (of *intercourse?*). 3. The *average* duration of the pregnant state, when calculated from this event, is about 275 days, or it may have a range of from 270 to 280 days. 4. There is no full or satisfactory evidence of gestation having been prolonged beyond 293 days. 5. The Code Napoléon, which allows 300 days, may be regarded as liberal. 6. The menstrual period must generally serve as our guide in default of some exact knowledge; it is, however, often fallacious, and is only a means of approximation to the probable time of parturition. 7. The fortieth week after the last appearance of the menses is the most likely period, and the forty-first week the next.' Strathy ('Brit. Med. Jour.,' 1876, i. p. 505), after giving a case of his own which reached to 298 days after the last intercourse in the married state, refers to reported cases by different authorities in which the periods were as follows:—Bently, 291 days; Skey, 293; Macilwain, 293; Reid, 287 to 293; and Ashwell, 300.

M. Duncan ('Edin. Month. Jour.,' 1854, vol. ix. p. 230) draws the following conclusions regarding the duration of pregnancy:—1. That the interval between conception and parturition (the real duration of pregnancy) has not been exactly ascertained in any case. 2. That the average interval between insemination (intercourse) and parturition (commonly called the duration of pregnancy) is 275 days. 3. That the average intervals between the end of menstruation and parturition have no standard length, but vary within certain limits. 4. That while absolute proof of the prolongation of real pregnancy beyond its usual limits is still deficient, there is evidence to establish the probability that it may be protracted beyond such limits to the extent of three or even four weeks.

Duncan, of Shetland, has fully reported the case of a woman who, in her first pregnancy, was not delivered until 300 days after the last menstrual period. The second and third pregnancies lasted for about 285 days. In the fourth, to which he especially refers, she carried her child 325 clear days from the last menstruation, the longest period recorded excepting in one other case. ('Med. Times and Gaz.,' 1877, ii. p. 712.)

It will be perceived from the conclusions of Reid, that he admits a variation of 23 days, *i.e.* from 270 days (the shortest period) to 293 days, the longest known to himself from a single intercourse. There appears to be no valid reason why the variation should not be even greater than that which is here assigned, and why the duration of pregnancy might not extend occasionally to 296 and even to 301 days. It is merely a question of individual experience. An accoucheur who admitted a variation of 23 days, and who had known gestation to be protracted to the 293rd day after intercourse, would hesitate to pronounce a child illegitimate merely because it had been born on the 296th or the 300th day after possible access of the husband. There is, no doubt, a limit to gestation, but it is not in our power to fix it: hence we find obstetric writers of repute adopting periods which have no point of agreement among themselves. Some stop short at 280 days; others, like Reid, fix the maximum yet known at 293 days; Murphy allows from his experience at least 324 days; and Meigs considers that gestation may be continued to twelve months, or 365 days.

('Obstetrics, the Science and the Art,' 1849, p. 194.) The fact is, the term has not yet been fixed even approximately by medical science; hence, in a disputed case, other circumstances must be looked to in order to lead a court of law to a safe decision. It is at present hopeless to reconcile the conflicting medical opinions which exist on the subject of the duration of pregnancy in the human female. There is, indeed, only one point on which all modern observers agree—namely, that the period cannot be limited to a fixed and invariable number of days or weeks, but that it is liable to variation according to circumstances not fully understood.

In *Renouf* v. *Eden* (Queen's Bench, March, 1870), an action for seduction, the defendant denied his liability on the ground that the plaintiff, æt. 19, was not delivered until 301 days after their last interview. Medical evidence was given for the plaintiff, that protraction to this extent was possible, one of the witnesses (Tanner) having seen a case beyond 293 days. Barnes and Tyler Smith, on the part of defendant, would not say it was impossible, but thought it highly improbable that gestation could have been thus protracted. The Lord Chief Justice, after referring to several cases of protracted gestation recorded in this work, assumed that it was possible the defendant might have been the father of the child, and summed up on the question of seduction. The jury gave a verdict for damages, thus affirming that the defendant was the father of the child. ('Med. Times and Gaz.,' 1870, i. p. 290.)

It has been elsewhere observed that the date of intercourse does not furnish us with the date of conception (pp. 639, 641), and, according to some authorities, all evidence connected with the function of menstruation is untrustworthy. In spite of these objections, the menstrual period must generally serve as a guide in default of more certain criteria. It is, however, curious that the date of the cessation of the menses is taken by some physicians as a guide (in married life with constant intercourse), so long as gestation does not extend beyond 280 days; while, supposing it to extend to 300 days, they will assume that some other cause than pregnancy must have led to an earlier suppression, and thus to an error in the calculation. There may be no more evidence of suppression from a morbid cause in the one case than in the other, and the period of 280 days may be as much based on error as the period of 300 days. It is strange that those that adopt this mode of making facts square with a foregone conclusion, do not perceive that they must, in fairness, either reject altogether the evidence derivable from a cessation of the menses, or admit it adversely to their own views, in cases in which the facts connected with the cessation have been as carefully observed and recorded by others as by themselves. No evidence on this subject can be drawn from an examination of the body of the child. There is no increase of size or development after the ninth month has passed. Children born at the full period of nine months have been larger and heavier than many children born, as it was believed, at a later period; but in cases of alleged protracted gestation it may be considered that the child should always have attained its full growth and perfect development.

Period of Gestation not fixed by Law.—In all cases of contested legitimacy, the question respecting the duration of gestation, when it arises, is left entirely open by the English law. No period of time has been fixed by English jurists within which, or beyond which, a child, if born in wedlock, will be presumed to be illegitimate. The decisions of our courts would be founded, quoad the duration of pregnancy, on the opinions of experts selected for the occasion, and each case would be decided on its own merits. Precedents can have but little influence on these occasions, because a court may think fit to pronounce illegitimate, on non-medical grounds, a child born in the thirty-eighth week of gestation, while it may decide that another was legitimate that had been born in the forty-third week. By some law authorities *forty* weeks (or 280 days), and by others forty-three weeks (or 291 days), have been taken as the *ultimum tempus pariendi;* but it is not the custom of courts to act upon any definite rule. Nevertheless, it is clear in some extreme cases that the law may fairly interpose, and pronounce for a reasonable limit. In the case of *Cotterall* v. *Cotterall* (Consist. Ct., July, 1847), a child was born during the marriage, and the husband proceeded against the wife for a divorce on the ground of adultery. The main proof was based on the fact that, in order to have been the child of the husband, it must have been born after *twelve months'* gestation. Lushington, without entering into the question of protracted gestation, upon proof of this allegation, at once pronounced for the divorce. Such a duration of pregnancy is not supported by any known facts, and is altogether opposed to medical probability. In suits of contested legitimacy, the general practice consists in establishing possibility of access on the part of the husband; when this is proved, the medical question arises whether the term of gestation falls within the limits assigned by the best medical experience. In two instances, children have been pronounced legitimate, which were born, the one in forty-one weeks and three days, and the other in forty-one weeks and four days, after the death of the husband. Legitimacy has been allowed where gestation was probably protracted to the *forty-third week.* (*Anderton* v. *Gibbs*, 1854.) In the United States, a decision in favour of paternity has been made in a case in which gestation extended to *forty-five weeks* and two days. (*Commonwealth* v. *Porter.*) Legitimacy has been disallowed in the English courts, although probably on non-medical grounds, where it was protracted to *forty-four weeks* and three days (*Gardner Peerage* case, 1825); in one case paternity was denied (judicially) because gestation had extended to *forty-two weeks* and five days (*Luscombe* v. *Prettyjohn*), and in another (*Dyson*) because it had extended to *forty-eight weeks.*

Stolz, after stating that the ordinary period of gestation is from 270 to 280 days, admits that it may extend to a fortnight beyond the latter period, but not longer, whatever may be the circumstances to cause protraction. Protracted labour, extending over five or six days, must not be included in this term. The death of a child may favour its retention *in utero*, and thus add to the apparent length of gestation.

The Code Napoléon cuts short all difficulties respecting the period of gestation, in cases of contested legitimacy, by fixing upon the term of 180 days after marriage and 300 days after dissolution of marriage or non-access, between which periods children born may be regarded as legitimate. In Germany, it is laid down that gestation may be protracted to 301 or 308 days, but not beyond. The general law of Germany places the period for ordinary gestation among women not married, at 285 days, but for a married woman divorced, or whose husband has died, it allows 302 days. Hohl, who records these facts, thinks that there is injustice in this fixed rule regarding time, and that in exceptional cases a period of from 322 to 336 days might be admitted. ('Ann. d'Hyg.,' 1873, t. 2, p. 153.) It is more reasonable and just to leave the question of duration open, than to fix it by assigning arbitrary periods, to which there must necessarily be numerous exceptions.

PATERNITY.

CHAPTER 57.

DISPUTED PATERNITY.—PARENTAL LIKENESS.—AFFILIATION.—POSTHUMOUS CHILDREN.—SUPERFŒTATION IN RELATION TO LEGITIMACY.—SUPPOSITITIOUS CHILDREN.—SEXUAL MALFORMATIONS.

Disputed Paternity. Parental Likeness.—It has been stated that the law does not pretend to determine who begat a child when it has been born during wedlock, and from circumstances it might be the child either of the husband or of an adulterer. But medical jurists have recommended that family likeness should be looked to on these occasions—not merely a likeness in *feature* and figure, but in gesture and other personal peculiarities which may have characterized the alleged parent. These are called questions of *paternity:* they seldom occur except in reference to cases of bastardy, and, when they do present themselves, the evidence thus produced, even if affirmative, is properly regarded as only corroborative. In the *Townshend Peerage* case (House of Lords, May, 1843), a presumption based on family likeness was admitted. The person whose legitimacy was in question was sworn by one of the witnesses to bear so strong a likeness as a child to the alleged adulterer, that he should have known him among five hundred children.

The proceedings in the *Douglas Peerage* case (1767–9) show that evidence of this kind is occasionally of some importance. The peerage was claimed by Archibald Douglas—the survivor of two brothers after the death of the alleged parents, Sir John and Lady Douglas. The claim was disputed, on the ground that the appellant and his deceased brother were supposititious children. Evidence for and against the legitimacy of the claimant had been collected from every quarter, and, after it had been most minutely sifted and criticized, the case came on for judgment, in the Court of Session in Scotland, on July 7, 1767. So important was the cause deemed, that the fifteen judges took eight days to deliver their opinions. The result was that seven of the judges voted in favour of the identity or legitimacy of Mr. Stewart, and seven against it; the Lord President, who had the casting vote, agreed with the latter, by which Archibald Douglas, *alias* Stewart, was cast on the world without either name or estate. An appeal from this decision was taken to the House of Lords, by which the judgment of the Court of Session was reversed in 1769, and Archibald Stewart (or Douglas) declared to be the undoubted son of Lady Jane, the sister of the previous holder of the title. Much stress was laid, in favour of the legitimacy of these children, on the fact that they closely resembled—the one Sir John, and the other Lady Douglas. The resemblance was said to be general; it was evident in their features, gestures, and habits. Lord Mansfield, in delivering judgment, made the following remarks, which comprise all that can be said on this subject:—'I have always considered likeness as an argument of a child being the son of a parent, and the rather as a distinction between individuals in the human species is more discernible than among animals. A man may survey ten thousand people before he sees two faces exactly alike; and in an army of a hundred thousand men, every man may be known from another. If there should be a likeness of feature, there may be a difference in the voice, gesture, or other characters, whereas a family likeness runs generally through all of these; for in everything there is a resemblance, as of feature, voice, attitude, and action.' This kind of evidence has been objected to from its uncertainty; and it was in this instance much disputed whether one of the children did resemble Lady Douglas, but it seems to have been generally admitted that the other child resembled the husband, Sir John. From this account it will be seen that evidence from family likeness is not strictly medico-legal; it can be furnished only by friends and relatives who have known the parties well, and are competent to speak of the facts from personal acquaintance with them. It will also be apparent that the affirmative evidence in such cases will be stronger than that which is negative, for it could hardly be inferred that a person was illegitimate because he did not resemble his parent. The view taken by Lord Mansfield is based on physiological truth. The resemblance is not in features only, but in gesture—in the mode of walking, sitting, or running, and in certain habits which are really inherited, for they appear in the child when it has reached manhood, although the child may have had no knowledge of its parent.

One of the witnesses in the *Tichborne* case (*Reg.* v. *Castro* or *Orton*, May, 1873), speaking to the identity of the Claimant with Arthur Orton, chiefly relied on these grounds. He had known the Orton family for many years, and knew the Claimant from his infancy up to the time of his leaving England in 1852. In 1870, he saw the Claimant, then representing himself as Roger Tichborne; but the witness at once recognized him as the Arthur Orton whom he had known as a child, a boy, and a young man. When cross-examined on his reasons for this strong opinion after the lapse of many years, he said he had formed his opinion, 'not from likeness of features alone, but from the whole appearance of the man—his figure, his tone of voice, his features, all confirmed it, and, in fact, he could see no real difference.' Other witnesses deposed that he had the features, voice, and figure of the father of Arthur Orton.

Parental likeness may be occasionally indicated by colour or peculiarities belonging to the varieties of mankind, as of the intermixture of the negro or Mongolian with one of the Caucasian variety. In such a case, the evidence afforded becomes much stronger; and, supposing that two men of different varieties have had intercourse about the same time with the same woman, the colour of the skin of the offspring might enable a court to determine the question of paternity. It is stated to have happened, on more than one occasion, that a black woman has given birth at the same time to a black child and a mulatto; Cunningham refers to a case in which a negress gave birth to twins—one a black and the other a white child. ('Lancet,' 1846, i. p. 525.) This was probably a case of superconception. In *Stothard* v. *Aldridge* (Bail Ct., Jan. 1856), the plaintiff sued the defendant for damages for the seduction of his wife. The defendant was a man of colour, and the child born of the alleged adulterous intercourse was proved by the medical witness to have been born coloured and with woolly hair. The husband and wife were both light. This peculiarity fixed the paternity of the child on the black defendant.

Personal *deformities* are not necessarily transmitted from parent to child; yet it would appear, from the subjoined case, that a disputed question of affiliation has been settled on this principle. A woman alleged that a gentleman in whose service she had lived was the father of a child of which she had been recently delivered. The solicitor who appeared to support the affiliation rested his case chiefly on the fact that the child had been born with five fingers and a thumb on the right hand, the defendant himself having been born with a similar malformation on both of his hands. It was argued, on the other side, that the deformity might have arisen from the mother's imagination, as, while pregnant, she was constantly in the habit of seeing the defendant. The magistrates decided that he was the father of the child, and condemned him to pay the necessary expenses for its support. ('Med. Times,' 1847, i. p. 47.) It is very likely that the decision was here influenced by moral circumstances, for otherwise the defendant might have been the victim of a coincidence. Six-fingered children are, it is well known, born occasionally of five-fingered parents; and as the deformity existed only on one hand in the child, while it was on both hands in the parent, the medical proof that it was actually transmitted by generation was certainly not clearly made out. In some instances attempts have been made to fix the paternity of a child by the *colour of the hair*, but this evidence is far less conclusive than that afforded by the colour of the skin. In the case of

Frazer v. *Bagley* (Feb. 1844), it was alleged that the wife of the plaintiff had had criminal intercourse with the defendant, and the last two children were stated to be the offspring of the latter. The plaintiff and his wife had dark hair, as well as all the children with the exception of the two last: these had red hair, and it was further proved that the defendant had red whiskers and sandy hair. No particular stress was laid upon this evidence, but it was received as a kind of indirect proof. Not much confidence can be placed in facts of this description, since red-haired children are often born to parents who have dark hair; and in one case the children born in wedlock were observed to have dark and red hair alternately.

Affiliation.—Questions of paternity are involved in those relating to *affiliation.* A man may allege that he is not the father of a particular child, by reason of certain circumstances upon which a medical opinion may be required. The necessary transmission of gonorrhœa or syphilis by intercourse may thus become a medical question. A man was required, under the law of bastardy, to support two children alleged by a woman to be his, the time of gestation being within nine months. The accused denied that he had had intercourse with the woman, or that he could have been the father, since he was at the time under medical treatment for the venereal disease. The medical questions may, therefore, assume this shape:—1. Are these diseases invariably transmitted by intercourse? 2. Do they interfere with the act of procreation? Under common circumstances, they must both be answered in the negative.

Two men, A and B, had intercourse, unknown to each other, with a young woman of delicate health; and after this had continued for some years, she was delivered of a female child—nine calendar months and three days after sexual intercourse with A, and nine calendar months less five days after similar intercourse with B; that is, a period of *eight days* elapsed between the periods of intercourse with the two men. The woman had no menstrual discharge in the mean time, and it is not believed that she knew any other man; she went her full time, had a good labour, and produced a healthy girl; she had a plentiful supply of milk, and enjoyed better health during her pregnancy and suckling than at any other time. The woman died, and the circumstances of the mixed intercourse having become known to A and B, they both refused to maintain the child. A contended that, as the woman was not delivered until nine months and three days after the connection with him, it was physically impossible that the child could be his. B contended, on the other hand, that 280 days, and not nine months, is the period of gestation; and that the child having been born 279 days after connection with A, and only 271 days after connection with B, it was therefore probable that the child was begotten by A. There was no perceptible likeness to either of the men in the child, but a marked likeness to the mother. ('Lancet,' 1847, i. p. 336.) It is obvious, from the remarks elsewhere made (*ante*, p. 649), that the periods of 271 and 279 days are comprised within the ordinary range of gestation: hence there would be no *medical* ground for affiliating the child to one more than to the other. When two men have had intercourse with the same woman on the same day, it is impossible to settle the paternity except by the accident of likeness; as in the former case, justice to the offspring and to each possible father requires that each should be bound to support the child. In cases of affiliation under the law of bastardy, the evidence of the mother, if corroborated, is received in support of a question of disputed paternity; but sometimes these cases are decided by the length of the period of gestation. A man may prove, or a woman may state, that the intercourse took place at such a remote period as to be inconsistent with the ordinary duration of pregnancy. On this point some remarks have been made already (*ante*, p. 655). In this country, the tendency is to reject medical evidence altogether in bastardy cases. In one case, the date of intercourse was proved to have been 319 days before the birth of the child. The medical evidence, on the whole, was in favour of this protraction—one of the witnesses having met with two cases in which gestation was protracted, as he believed, to 310 days from intercourse—but the case was summarily dismissed.

These questions of affiliation, when the interval is less than six or eight weeks, can rarely be determined by medical evidence. In a case of affiliation, an attempt was made to set aside the order of a magistrate fixing the paternity on the putative father, on the ground that, as the intercourse was had, and the child conceived in France, although born in England, it was removed from the jurisdiction of an English magistrate, and should be left to the French courts. The objection was overruled, and the alleged father was ordered to pay the usual sum for maintenance. The place of birth should properly fix the liability, as any other rule would be too vague. From what has been elsewhere stated, it will be perceived that intercourse might take place in Scotland, followed by conception in England, and birth in Ireland. So that there is a due relation between the date of intercourse and the date of birth, no other proof is required.

Posthumous Children.—It has been supposed that a case involving a question of paternity might present itself on the marriage of a widow soon after the death of her first husband. If a child were born after the lapse of ten months, it might be a question whether it was a child of the first or second marriage—of the dead or the living husband; and, although there might be no dispute concerning its legitimacy, yet it would be difficult to settle its *paternity*. Such a case appears hypothetical. In order that any doubt should exist, a woman must marry within, at the furthest, *six weeks* after the death of her first husband, or the birth of the child would fall beyond the furthest limit of gestation so far as he was concerned. The customs of society are, however, a bar to such marriages; and admitting that a child was so born, and that it might be the offspring of either husband, then the fact of its having been born during the marriage of the second husband would presumptively fix the offspring upon him, unless it could be shown that there was no possibility of access on his part. If there was a supposed greater likeness to the first than to the second husband, still this would not be allowed to defeat the legal presumption of the real parentage of the child. It appears that evidence much stronger than this would be required for such a purpose. (See Henke's 'Zeitschrift,' 1838, vol. 2, p. 432.)

Superfœtation in Relation to Legitimacy.—By 'superfœtation' we understand that a second conception may at any time follow the first, and that gestation may go on to its full period in each instance independently of the other; so that if a woman were impregnated when in the third month of gestation, she would bear the first child mature in nine months, and the second child, also mature, at the end of twelve months after the first conception. Its importance to a medical jurist appears to have been considerably exaggerated. Not only is there no legal case involving this question to be met with in the judicial records of this country, but none in reference to this state is ever likely to occur that would create the least practical difficulty. If we admit that a woman may during marriage present such a deviation from the common course of nature as to produce two perfectly mature and fully developed children, the one three or four months after the other, how can such an event be any imputation on her fidelity? Superfœtation, if it occur at all, may occur as readily in married life during connubial intercourse, as among unmarried women. The following appears to be the only possible case wherein a medical opinion might be required respecting this alleged phenomenon. A married woman, six months after the absence or death of her first husband, gives birth to an apparently mature child, which dies; three months afterwards, and nine months after the absence or death of her husband, she may allege that she has given birth to another child, also mature. A medical question may arise whether two mature children could be so born that the birth of one should follow three months after the birth of the other; or whether this might not be a case, by no means uncommon, of twin children—the one being born prematurely, and the other at the full period. (For a case of this kind, at two months' interval, see 'Lond. Med. Gaz.,' vol. xxxvii. p. 27; and for another, at eight days' interval, see the same journal, vol. xlvii. p. 227; for a third, at thirty-two days' interval, 'Amer. Jour. Med. Sci.,' 1845, p. 503.) In one case the abortion of one fœtus occurred at the third month, while the other attained the full period. ('Assoc. Med. Jour.,' 1853, ii. p. 997.)

Admitting that each child, when born, was mature and fully developed, and therefore that the second child presented a case of superfœtation, the first delivery must have taken place in the presence of witnesses, and it would then have been known whether another child remained in the womb or not. If the two children were born within the usual period of gestation after the absence or death of the husband, then their legitimacy would be presumed, until the fact of non-access had been clearly established. The mere circumstance of their being apparently mature, and born at different periods, would *per se* furnish no evidence of their illegitimacy. On the other hand, if one or both of them were born out of the ordinary period, then, according to the evidence given, they might or might not be pronounced illegitimate. The law, therefore, appears to have no sort of cognizance of the subject of superfœtation as such; it is generally merged in the question of protracted gestation, which has already been fully considered (p. 649).

Bonnar has examined the subject of superfœtation in another aspect, and some of the facts which he has brought forward are not consistent with the theory of the births of twins at different intervals. ('A Critical Inquiry regarding Superfœtation, with Cases,' 1865.) The first question to which his researches were directed was—At what period after parturition are the female procreative organs capable of again exercising their functions? It has been supposed that a period of thirty days must elapse in order to enable the organs to reacquire procreative power; but, according to Bonnar, the earliest period may be taken at the *fourteenth day* after delivery. Impregnation is not likely to take place until the organs have resumed their natural condition, and this will depend on the disappearance of the signs of recent delivery—such as the tender and swollen state of the vagina, the enlargement of the womb with its relaxed mouth, and the lochial discharge. The persistence of the lochial discharge, the average duration of which after delivery Bonnar considers to be from one to three or four weeks, is of the greatest importance, as it is most likely to interfere with impregnation. The time for the restoration of the sexual organs to their natural state varies in different women, so that the date for reimpregnation must be more or less conjectural.

It has been usually considered that, after the second or third month of pregnancy, the cavity of the womb is so sealed up in the development of the embryo as a result of impregnation, that it is impossible that any fruitful intercourse can take place. In two instances, however, according to Bonnar, viable children were born of the same woman at five and a half and four months respectively after the first delivery. On the theory of superconception, the uterine organs must have been susceptible of a second impregnation up to the fourth month of gestation. But if the children were not born mature, the power of reimpregnation must have existed for one or two months longer than the period usually assigned—*i.e.* up to the fifth or sixth month of a pregnancy already existing. These researches may help to explain some legal difficulties which have occurred in reference to gestation. They furnish a curious comment upon the suggestion made by some medical jurists, that superfœtation involves the conjugal fidelity of a wife, for no suspicion of illegitimacy could be for a moment entertained simply on account of the shortness of the interval between the two deliveries of the same married woman.

Supposititious Children.—Another medico-legal case, in relation to legitimacy, occurs when a woman feigns delivery, and represents the child of another person to be her offspring. She may substitute the living child of another woman for a dead child of which she herself has been delivered, or for a mole which may have passed from her. So, again, a male may be substituted for a female child, and *vice* *versâ.* The practising of a fraud of this nature may seriously affect the rights of inheritance of parties; but it cannot be accomplished without great dexterity and cunning, or without the co-operation of one or more accomplices. Frauds of this kind have, in general, been committed by the aid of a low class of midwives. One instance occurred at Chelsea, in July, 1842, where the fraud was brought to light by the death of the supposititious child. The calling in of a professional man would lead to discovery, when the question was simply whether delivery had or had not taken place; but if it be alleged that one living child has been substituted for another, the proof of this can depend on medical evidence only when the age of the supposititious child does not happen to correspond to the date of the pretended delivery. ('Ann. d'Hyg.,' 1829, t. 2, p. 227.) The legitimacy of the claimant of the Douglas Peerage was disputed on this ground, but apparently without foundation. A remarkable case of this description will be found in Henke's 'Zeitschrift der S. A.' (1845, vol. 2, p. 172); and a trial took place some years since in England, involving the alleged substitution of a child, but requiring no medical evidence for its elucidation. (*Day* v. *Day*, Leicester Lent Ass., 1845.) In another case, it was proved that a woman had substituted a doll for the dead body of a child of which she pretended she had been delivered. In a case mentioned by Chevers, one *Mussamat Janoo*, a midwife of Hissar, being employed to attend a woman in her confinement, persuaded her that the child of which she had been delivered was a monster with two heads, not fit to be looked at; she afterwards said that it was dead, and she would take it away and bury it. She accordingly went away. Next morning, the midwife's services being required, she was sent for. She excused herself from going under the pretence that she (the midwife) had just been delivered of a child. This improbable story excited suspicion, and the police were called in: she declared that the child was her own. This she also maintained at the trial. It appeared, however, from the evidence of midwives who examined her shortly after the discovery of the child in her house, and also by the deposition of the civil surgeon, that she exhibited no signs of recent delivery. Several of the neighbours who were constantly in the habit of seeing her deposed that she had not exhibited any outward signs of pregnancy. She did not attempt to prove how she had disposed of the body of the child which she alleged had died immediately after its birth. She was convicted. ('Med. Jurispr. for India,' p. 512, from the 'Nizamut Adawlut Rep.,' 26th April, 1853.)

Cases involving a question of substitution are not very common. One of these (*Hutchins* v. *Hutchins*) was heard in the Vice-Chancellor's Court in May, 1851; and in this the amount of ingenuity required to perpetrate the fraud was only equalled by the skill with which the facts were exposed, and justice ultimately done to the rightful claimant. In another (*Gedney* v. *Smith*, Rolls Court, Nov. 1864) the fraud was nearly successful, and, but for the dying declaration of the woman herself, would probably have escaped detection and exposure. In the more recent case of *Lady Gooch* (1878), who was charged with fraudulently attempting to pass off a child as that of her husband, the facts were clear. She endeavoured to persuade a medical man to give a false certificate that she had borne a child, and she induced a nurse to procure a child and to give the appearance of a delivery while she was staying at a London hotel. A medical man who was called in, examined her, and found that she had not been delivered of a child, and that the child produced as recently born was about two weeks old. To carry off her fictitious pregnancy, she had worn pads to her abdomen. These proceedings had been carried on in spite of the remonstrances of a female attendant and her usual medical advisers, as well as the refusal of her husband to admit that she was pregnant. She was committed for trial, but the grand jury ignored the bill.

The cases that have hitherto been tried illustrate the importance of accurate observation on the part of medical men in their practice as accoucheurs. Notes of all cases should be made and preserved, including dates of attendance, &c.—daily symptoms and treatment. This should be an invariable rule when a medical man is suddenly called upon to attend, in her confinement, a woman who has not previously consulted him. If he has had no previous knowledge of the pregnancy of a woman, and if, when he arrives, the child is said to have been born and is in the hands of a nurse, he should most distinctly satisfy himself, by a personal examination, that the woman has been actually delivered. He should also observe whether the child presents the appearance of the new-born child in reference to the state of the skin; the appearance of the cut navel-string, and other circumstances. It is an awkward exposure for a medical man to hear at a trial, many years afterwards, that he has been cleverly made to give support to a fraud.

Sexual Malformation.—The legitimacy of a child is open to be contested under other circumstances than those connected with the duration of gestation. The alleged parent may have laboured under *physical incapacity:* if a male, he may have been affected with impotency—if a female, she may have laboured under sterility; and if either of these conditions be proved, the illegitimacy of a child will be established, although the alleged period of gestation may be comprised within the ordinary limits. The sexual conditions now about to be considered have also important bearings in relation to divorce, and occasionally to the civil rights of a child that may be the subject of the malformation. One of the most common and obvious causes of impotency or sterility is malformation of the sexual organs, to which species of monstrosity the term *Hermaphroditism* is commonly applied.

Owing to arrested development during the growth of the fœtus, the sexual organs, which can scarcely be distinguished at the fourth month, occasionally assume an abnormal arrangement. These organs appear to be at that time more or less mixed; and sometimes the male and at other the female characters predominate. With this defective sexual development, the other peculiarities of the sexes are either wanting, or more or less blended. When the being has the general characters of a male with malformation of the generative organs, it is called *androgynus;* when the characters are those of a female with a like malformation, *androgyna.* There can be no difficulty in identifying such cases, and, according to the degree of malformation, a medical jurist can have no hesitation in pronouncing these persons to be physically impotent. The organs are commonly so defective as to be wholly unfitted for the functions of either sex. It is not intended to be said that it is in all cases easy to assign the sex, but this is of minor importance: the main question is, whether the malformation is or is not such as to justify divorce, or to throw the imputation of illegitimacy upon children claiming to be the offspring of these beings.

Distinction of Sex.—The determination of *sex* in these cases of deformity has been considered to be necessary under certain circumstances; as when, for instance, a title or entailed inheritance of lands is in question. Lord Coke has stated that, according to the law of England, an hermaphrodite may be either male or female, and it shall succeed according to the kind of sex which doth prevail. Thus it is obvious that the law will decide each case according to the special circumstances proved, but it must not be supposed that the decision is so easy as Lord Coke's dictum would imply. There are many cases in which neither sex can be obviously said to prevail. The chief character of the male consists in the presence of testicles, and of the female in the presence of a womb and ovaries, but in one instance both the testicles and the ovaries were wanting; there were no essential characters of either sex, and during life it would have been impossible to say whether this being was male or female. (Cormack's 'Month. Jour.,' 1845, p. 492.) In the same journal (p. 531) is reported another case, in which, notwithstanding the *external* resemblance to a female, the presence of one testicle in a scrotum showed that the being was of the male sex: yet this person passed for a woman until he had reached his 26th year. It is rare that there is external malformation without internal defect, but even when the female character preponderates, it is not improbable that the womb or the ovaries may be absent, or the former may be malformed. Such beings are not known to menstruate, and, even if there should be capacity for intercourse, they are permanently sterile. Sexual desires are, however, commonly absent. When the person is young, mistakes respecting the sex are more common than at an advanced period of life. So soon as the age of puberty is past, certain changes take place in the configuration of the body, which may aid a medical practitioner in forming an opinion. Thus a grave tone of voice, the presence of a beard, the width of the shoulders and narrowness of the pelvis, will indicate, *cœteris paribus*, the male sex; while, when these conditions are absent, and there is a rotundity of the members, with want of prominence in the muscles, and a great development of the breasts and pelvis, the female sex predominates. Although no testicles are apparent, still the being may be of the male sex, since it is well known that in persons otherwise well formed these organs are not always found in the scrotum. As a rule, the female sex, whatever may be the sexual malformation, is clearly indicated by the performance of the function of menstruation. In the case of a girl, æt. 8, the pubes was found covered with black hair. There was a well-formed member like a penis, two inches long, capable of erection, but without any urethra. Below the penis there was a large urethra or meatus, and a pendulous vulva, with labia resembling testicles. The parents always had doubts about the sex, but, as the child menstruated regularly, it was a female malformed. ('Brit. Med. Jour.,' 1875, ii. p. 514.)

An external examination will sometimes entirely fail to indicate the sex, and even the opportunity of an examination of the dead body may leave the case in doubt. (For a report of a case in which a body resembling the prostate gland and a womb coexisted in the same being, see 'Med. Times and Gaz.,' 1860, i. p. 177.) A case has been already mentioned in which neither testicles nor ovaries were found after death, and more than one instance is said to have occurred in which both have been found. This last condition is a case of intermixture of the sexes, or, physically speaking, real hermaphroditism, but, of course, without the functional power of self-impregnation.

Medico-Legal Relations.—Persons in whom the sexual organs are defective or imperfectly developed, are impotent and sterile. Questions connected with the legitimacy of offspring, divorce, and affiliation may, therefore, be raised with respect to them. Sexual monstrosity is not a ground for depriving a being of the rights of inheritance, except under peculiar legal conditions. Thus a right of succession or inheritance to landed estate may depend upon the *sex* of the offspring: as where, for instance, two children are born, the first an hermaphrodite, the second a well-formed male child. The parents die, and a title of nobility or lands may fall to the firstborn male. Here the sex of the firstborn must be determined before possession can be had. In a case of this kind, if medical evidence should establish that male peculiarities predominate in the firstborn, the second child would be cut off. Again, if an estate were limited by entailment, as where it is settled upon heirs (male or female) of a particular family, the birth of an hermaphrodite, an only child, would create a legal necessity for a positive determination of the predominance of sex. So, if an hermaphrodite lives but a few minutes after its birth, and then dies, the rights of persons may be subsequently much affected by the opinion of the medical attendant respecting its sex. Since we cannot determine under what circumstances litigation may ensue, it is always right in a doubtful case to observe the sex, and make notes on the spot when a child thus malformed survives its birth but for a short period. The question of tenancy by courtesy, or the right of the husband to landed estate of which the wife was seised, will depend entirely upon the attention of the accoucheur to this point.

When these beings have reached adult age, other questions may arise with respect to them. The English law does not allow them to select their sex, but determines it for them by medical evidence.

Hermaphrodites, or sexual monsters, were formerly ranked with infamous persons; and it has been a grave question in our courts, whether the calling a man an hermaphrodite was not such a libel or slander upon him as to render it a ground for a civil action. In a case reported by Chitty ('Med. Jur.,' p. 374), the use of this term was held not to be actionable unless it was proved that it had been attended with special damage. A dancing-master brought an action against a person for calling him an hermaphrodite, and it was decided that it was not sustainable:—1. Because such a union of the sexes cannot exist in fact, and every one must be supposed to know it; consequently the assertion could not be supposed to prejudice. 2. Because, admitting the possibility of such a double function, the party would be just as good, and, perhaps, even a safer dancing-master than if only one perfect sex had been discoverable; consequently, the words would not, in legal presumption, injure him in his profession or occupation.

It would appear that, in the United States, the rights of citizenship, and the privilege of voting for members of Congress, have depended on the determination of sex. In 1843, Barry was requested to examine a person named *Levy Suydam*, aged 23 years. At the exciting and warmly contested election of the spring of that year, almost everything bearing the semblance of the human form and of the male sex is stated to have been brought to the ballot-box. It was at this time, and under these circumstances, that the above-mentioned person was presented by the Whigs to be made a free*man*; he was challenged by the opposite party, on the ground that he was more a female than a male, and that in his physical organization he partook of both sexes. Without going into the details of his physical organization, it may be stated that, as he was found to have a penis and one testicle, the privilege of a vote as a *male* citizen was conceded to him. It was, however, subsequently proved that this being regularly menstruated, and that it had other female peculiarities. This was certainly an embarrassing case,—one to which Lord Coke's rule for a decision, *i.e.* the prevalence of either sex, is hardly applicable. The presence of a penis and one testicle referred the being to the male sex; while the bodily configuration, and still more strongly a periodical menstrual discharge, referred it to the female sex. The right of voting might have been fairly objected to, because, while the female characters were decided, the organs indicative of the male sex are described as having been imperfectly developed. It is possible that the question of sex may be mooted under similar conditions in this country.

IMPOTENCY. STERILITY.

CHAPTER 58.

IMPOTENCY.—CAUSES.—PROCREATIVE POWER IN THE MALE.—PUBERTY.—AGE FOR VIRILITY.—VIRILITY OF CRYPSORCHIDES AND MONORCHIDES.—STERILITY.—PROCREATIVE POWER IN THE FEMALE.—EARLIEST AND LATEST PERIODS FOR CHILD-BEARING.—LEGAL RELATIONS.

Definition.—Impotency is defined to be an incapacity for sexual intercourse. It may depend—first, upon *physical*, second, upon *moral*, causes. With regard to the *moral causes* of impotency, they do not concern a medical jurist. Such causes are not recognized by law, and he has no duty to perform beyond the application of the principles of medicine to the purposes of the law.

Causes.—Impotency may arise from *age;* from certain *physical causes, e.g.* disease; or from congenital malformation or *defect.* With regard to *physical* causes, a distinction must be made between those which are remediable and those which are not. The presence of a disease of the testicle, such as atrophy or tumour, may give rise to incapacity; but this incapacity may be sometimes removed by an operation or by medical treatment, and therefore the physical cause may be removed,—in other words, it is *remediable.* To such cases as these the law does not extend; but it is always expected, in alleged incapacity, that the practitioner examined on the subject should be able to say whether there is or is not a prospect of cure. In forming a judgment upon this point, a good knowledge of his profession can alone assist him; no rules can be laid down for his guidance, for there may not be two cases that will precisely resemble each other in their features. Hence it will be necessary in this place to point out the chief causes of impotency which are of an irremediable nature, or those in which the incapacity is absolute and permanent—a point upon which medical opinion is chiefly required.

In strictness of language, the definition of impotency, as above given, may be applied to a *female* as well as a male; and, undoubtedly, a physical incapacity for sexual intercourse may exist in either sex. As an instance of this incapacity in the female, may be mentioned occlusion of the vagina—a condition not necessarily indicative of sterility. The mere occlusion of the vagina may be a remediable form of the malady; but its entire obliteration would be an absolute and irremediable defect. This latter condition, however, is the only instance of complete impotency in a female. A protrusion of the womb or of the bladder into the vagina is mentioned by some writers as a cause of physical incapacity for intercourse; but these forms of disease may commonly be remedied by art, and therefore require no further notice in this place. The editor was once consulted by a gentleman who alleged that anchylosis of the hip-joint of his wife—the broken limb being flexed across the entrance to the vagina—was a bar to sexual intercourse. It is unlikely that intercourse was absolutely impossible under the circumstances; and it is known that even double anchylosis of the hip-joints is not an insuperable bar to coitus.

In professional language, the term 'impotency' has been hitherto applied exclusively to a defect in the *male* sex; and the term 'sterility' is usually confined to all those conditions in the female which not only render intercourse impossible, but which render it unfruitful. A male may, however, be sterile without being impotent—a condition observed in some crypsorchides; or he may be impotent without being sterile, as where proper intercourse is prevented by reason of physical defect in the virile member, although the testicles may be in a normal condition. (See on this subject, Curling, 'On Sterility in Man.') This author points out that sterility in the male, apart from impotency, may depend on three causes: first, malposition of the testicles; second, obstructions in the excretory ducts; and, third, impediments to the escape of the seminal fluid. A man may not be impotent, *i.e.* incapable of intercourse, but, by reason of one of the conditions above mentioned, such intercourse would be unfruitful. In reference to the male, the English law does not appear to go beyond the establishment of impotency from some clear and demonstrable cause, and, unless the alleged sterility were accompanied by impotency, it would take no cognizance of that condition. Further, sterility from such causes could hardly be demonstrated during the life of a person—it would rest chiefly on presumption or probability.

Procreative Power in the Male. Puberty.—Until the period of puberty, the testicles are small, and they increase very little in size in proportion to other parts. Curling found that the size of the seminal tubes differed but little at the ages of 18 months and 8 years. The sexual function in the male depends entirely on the development of the testicles; but the age at which it appears differs in different persons. The age of puberty in a healthy male in this country varies from 14 to 17 years; its appearance is, however, affected by climate, constitution, and the moral circumstances under which the individual is placed: in some cases it is not fully developed until the age of 21.

The access of puberty in the male is indirectly connected with the subject of rape. A boy under the age of *fourteen years* is presumed in law to be incapable of committing a rape. (1 Hale, p. 631; and Matthew's 'Digest,' p. 57.) The statute law merely requires proof of penetration, so that rape might be physically perpetrated by a boy at or even under 14 years of age. In several cases, boys at 14 have been convicted of rape. In a case elsewhere related (see Rape), a boy, aged 19, communicated syphilis to a girl of 6 years of age. It appears that in India puberty shows itself much earlier in the male. Chevers, quoting from the 'Nizamut Adawlut Reports,' states that a boy of 13 or 14 years of age was found guilty of rape. A lad of 14 was convicted of rape on a girl of the same age; and in another case a boy only *ten years* old was convicted of rape on a girl 3 years of age. ('Med. Jurispr. for India,' p. 463.)

The seminal secretion in the male is not considered to be prolific until it contains those peculiar filiform bodies which are known under the name of *spermatozoa*, or zoosperms. All agree that they are normal and essential constituents of the healthy and prolific seminal fluid. They are peculiar to the spermatic secretion, and, in healthy males, are always present in it after the age of puberty. They disappear in certain states of disease, and sometimes in advanced age: they have not been found in the undeveloped testicles of crypsorchides. In cases in which they are absent, from whatever cause, it is a fair inference that the person is impotent, or that he has lost the power of procreation. (See on this subject, Curling, 'On Sterility in Man.') In this pamphlet, one case is related in which a man, æt. 42, who was married, and whose wife had borne a son then eight years of age, had died after four days' illness from strangulated hernia. The testicles, from the fact of their being found in the inguinal canal, were examined separately by Gosselin and Godard, and no spermatozoa were discovered in the fluid contained in either of them; but these may have been merely absent at the time of examination, as the child begotten was then eight years of age. During this long interval, the secretion may have undergone a change, and have become unprolific.

Impotency from Age.—It may be fairly assumed that a male is incapable of procreating until spermatozoa have appeared in the seminal secretion, and that he loses this power when they disappear. The *age* at which they are formed varies with all the causes that affect puberty. In one instance they were found by Casper in the seminal fluid of a crypsorchid boy only 14½ years old, and Curling found them in the secretion of a boy aged 18. This observer found spermatozoa in the liquid taken from the testicles of a man upwards of 70 years of age, and on one occasion in the testicles of a person aged 87. Wagner states that they are to be found in the secretions of men between 70 and 80 years of age. Rayer found them in the secretion of a man aged 82 years. ('Gaz. Méd.,' June 2, 1849.) Other cases of a similar kind are recorded by Debrou. ('Gaz. Hebd.,' 1861, p. 6.) Dien examined the bodies of 106 men between the ages of 64 and 97. In 64 cases out of the 106, there were no spermatozoa, *i.e.* in 61 per cent. Four of Dien's observations were on nonogenarians: of these none had spermatozoa. ('Med.-Chir. Rev.,' June, 1868, p. 279.) Facts tend to render it highly probable that a fecundating power may be retained by the male up to the age of 100. According to Duplay, the seminal fluid of old men contains spermatozoa even when they are beyond the age of fecundation ('Med. Times and Gaz.,' 1853, i. p. 581); but he does not state the circumstances which enabled him to arrive at this conclusion. Sexual propensities are often strongly developed in children, and thus they may be prolific at an early age. Rüttel met with a case in which a female, at the age of 14, became pregnant by a boy of the same age. (Henke's 'Zeitschrift der S. A.,' 1844, p. 249.) This is the earliest age at which, so far as we can ascertain, the procreative power has appeared in the male. Hartsborne refers to an instance of extraordinary development of the male sexual organs in a child 4 years old. ('Amer. Jour. Med. Sci.,' Oct. 1852, p. 561.) In a case of contested legitimacy or affiliation, this question regarding the age at which a procreative power appears in the male may have an important bearing on the issue. Thus the person may be so *young* as to render it impossible that he should be the father of a child imputed to him. Cases involving questions of legitimacy on this ground are not heard of in the present day.

The following case in reference to the affiliation of children occurred in 1840. A woman wished to affiliate a child on a youth who was in his *sixteenth* year. The boy denied that he was the father of the child; and there was reason to suspect that the imputation had been wrongly thrown upon him in order to divert suspicion from the real offender. There was some difficulty in this case; but the rule for a medical man to follow on these occasions is this: not to regard the mere *age* of the youth, whether he is above or below the average age of puberty, but to observe whether the sexual organs are fully developed, and whether there are about him any of the marks of precocious virility, indicated by muscular development, the growth of a beard, and a manly voice. If these signs are present, whatever may be his age, there is strong reason to suppose that the sexual functions are developed. We occasionally hear of instances of extraordinary precocity; but the development of sexual power is generally accompanied by other well-marked changes in the person. Sometimes these changes do not make their appearance until after the age of 21.

On the other hand, it may be a question at what time the procreative power disappears in a male. That impotency is one of the natural consequences of *advanced age* is undoubted; but this, as we know, forms no legal impediment to the marriage of parties, however old. The legal presumption is that the generative faculty does not disappear through age; and if this be alleged, and legitimacy disputed on this ground, it must be satisfactorily proved by those who would benefit by the allegation. This amounts almost to an impossibility, because it is well known that there is no fixed age at which the sexual functions cease either in the male or female; and individuals at least of the male sex, who have passed the ages of 60, 70, and even 80 years, have been known to be capable of fruitful intercourse. Duplay believes, from his anatomical observations on the bodies of aged persons, that the causes of impotency (sterility) in advanced age are to be found rather in the excretory than in the secretory apparatus. Thus he has met with obliterations in the canal of the epididymis, the vas deferens, and the vesiculæ, the effect of which is to prevent the accumulation and passage of the seminal fluid. ('Med. Times and Gaz.,' 1856, i. p. 650.) Lord Erskine, in the *Banbury Peerage* claim, quoted the case of Sir Stephen Fox, who was married at 77, and had had four children, the last when he was 81. Schneider met with a case in which a man of 71 had a child by his wife, who was only 17. (Henke's 'Zeitschrift,' 1842, vol. 2, p. 165.) Rüttel mentions the case of a man who, at the age of 92 years, married and had two children by his wife. When the procreative power even appears to be lost at advanced age, the stimulus for intercourse is often very great. The same authority mentions cases in which these erotic feelings were remarked by him in reference to men between 75 and 86 years of age. (Henke's 'Zeitschrift,' 1844, p. 252.) In all cases of prolonged virility, it is observed that the bodily and mental powers are also retained in an extraordinary degree, showing the close relation which exists between the sexual functions and corporeal and mental development, even to the latest period of life. Romilly remarked, in reference to the retention of procreative power in advanced age, that the liberality of the English law on this subject was excessive; for there was no age, from *seven* upwards, at which a man had been denied the power of procreating children. (See, in reference to this subject, Henke's 'Zeitschrift der S. A.,' 1842, p. 332.) Males at the age of 14, and females at the age of 12, are legally competent to contract marriage.

Impotency from Local Disease or Accident.—The loss or destruction of the penis or testicles, either by disease, accident, or from necessary operations, would be sufficient to render a man irremediably impotent. The loss of one or both testicles, from any of these causes, would be indicated by the presence of distinct cicatrices in the scrotum. When both have been removed by operation, the person is incurably impotent; but if the organs are healthy, a sufficiency of the spermatic fluid to confer procreative powers may remain in the ducts for two or three weeks after the operation. Thus it is that animals have been known to be prolific for some time after castration; and one case is on record, in which a man, both of whose testicles had been carried off by a gunshot, is said to have retained the power of impregnating his wife after the healing of the wound. (See a paper by Krügelstein, Henke's 'Zeitschrift,' 1842, vol. 1, pp. 348 and 352.) The loss of *one* testicle only, by accident or operation, does not render a man impotent. *Monorchides*, as they are called, have been known to be prolific. Cases of this kind must not be confounded with those in which one or both testicles have not descended into the scrotum.

In some rare instances the testicles do not descend into the scrotum at the usual period; but one or both may remain either in the abdomen or in the inguinal canals, and only descend some time after birth; or one may be found in the scrotum, and the other remain during life in the abdomen. In some cases of partial descent, the organs have been mistaken for, and treated as, ruptures by the application of a truss. (Henke's 'Zeitschrift der S. A.,' 1844, vol. 1, p. 249; Curling, 'On Disease of the Testis,' edit. 2, p. 31.) In one instance, the attempt to reduce the tumour, mistaken for hernia, and the application of a truss, caused the death of the person. ('Med. Times and Gaz.,' 1861, ii. p. 240.) When one testicle only has descended, there is no ground, *cæteris paribus*, to impute impotency; the descended organ has been found healthy and to contain spermatozoa. Curling has collected six cases in which the retained testicle and its ducts did not contain spermatozoa: four of these fell under his own observation. ('On

Sterility in Man,' 1864, p. 6; and 'Med. Times and Gaz.,' 1861, i. p. 213.) When neither testicle has descended, the scrotum will be found empty, without any scar indicative of a removal by operation, but the other marks of virility may still be present. These persons have been called *Crypsorchides.* It has been stated that in such cases the testicles are to be regarded as congenitally defective, and further, that the individual, although capable of sexual intercourse, is incurably sterile.

The non-descent of the testicles is a state rarely seen. Marshall met with only one case of non-descent of one testicle in 1000 recruits, and with one case of non-descent of both testicles in 10,000 recruits. There are three preparations, showing the non-descent of these organs, in the Museum of Guy's Hospital; one of them was taken from a man who shot himself from despondency at his supposed defective condition. Hunter thought that the undescended testicles were always imperfect, both in their structure and functions, and that crypsorchides were invariably impotent (sterile). Some recent researches have tended to support the views of Hunter. In 1860, Partridge communicated to the Pathological Society the case of a man, æt. 25, in whom both testicles were found in the abdomen. Several specimens of the secretion from these organs were examined, and no spermatozoa were detected. Another case was examined with a like result ('Lancet,' 1860, i. p. 66), and a third by Curling ('Med. Times and Gaz.,' 1861, ii. p. 213). The conclusion to which these observations have led is that, although in cases of non-descent there may be a capacity of sexual intercourse, it will not be prolific—the person will be sterile. According to this view, malposition of the organs must be taken as synonymous with defective condition; as a result of this malposition, they are not capable of secreting prolific spermatic fluid, and the person is as sterile as if he had no testicles. The cases of monorchides reported by Curling to some extent support this theory, since spermatozoa were found only in the fluid of that testicle which occupied its usual position in the scrotum. He has also collected from various sources seven cases of crypsorchides, in which both testicles were either in the abdomen or in the inguinal canals: the fluid contained in them was destitute of spermatozoa, and, although impotency did not exist, these persons either were, or were presumed to be, unprolific. Godard has noticed that horses whose testicles are retained in the abdomen, although capable of intercourse, are sterile.

On the other side of the question there are, however, facts which are wholly inconsistent with this theory. The author published the account of two cases of crypsorchides communicated to him by Cock. The testicles in these men had not descended, but their virile functions were undisputed. One of them, before he had reached the age of 30 years, had been twice married, and had had children by each wife, besides illegitimate children which were affiliated on him. In a report of cases of hernia by Poland ('Guy's Hosp. Rep.,' 1843, vol. i. p. 163), there is the case of a man, æt. 29, a crypsorchid, whose testicles had not descended. Poland states that there was not the slightest trace of scrotum; the penis was well developed, and there were all the other signs of virility. This man had married when he was 20; he had had two children by his first wife, and at the time of his admission into the hospital, had been married two years to a second wife. In 1862 there was in Guy's Hospital a patient under Durham: the testicles of this man had not descended—they were lodged in the inguinal canals. The man was 32 years of age, well developed, with every appearance of virility about him, and with the same masculine development which is seen in other men of the same age. This man was married, and had had two children by his wife. Since puberty he had always been competent, and he ridiculed the idea that his testicles were inefficient. Another case is referred to by Curling, which occurred to Debrou. The testicles were in the inguinal canals; and there was no scrotum. The man had been married, and had one son by his wife. These facts prove that crypsorchides, in some cases, have a power of procreation like normally constituted men. Casper relates a case in which a crypsorchid was charged with an unnatural offence. He was a boy between 14 and 15 years of age, and it appeared that he had been guilty of unnatural conduct towards another boy 8 years of age. Spermatozoa were detected by Casper on his shirt sixteen days after the act. On examining the boy, both testicles were found in the inguinal canals. ('Gerichtl. Med.')

By these facts, therefore, it is satisfactorily established that *crypsorchides* are not necessarily sterile, and that no absolute rule can be laid down respecting the existence or non-existence of prolific power under such circumstances. It has been objected that, in the above instances of prolific power, spermatozoa had not been demonstrated to exist in the spermatic secretions of the individuals, and that the evidence was therefore incomplete. But these bodies were not proved to be absent, and most persons will agree that there is no better evidence of prolific power than the procreation of children, whether spermatozoa are or are not detected—a matter which will sometimes depend on the accuracy of observation or experience of the examiners, or, it may be, on a morbid state of the secretion. One affirmative instance is sufficient for all the purposes of law; and, as a physiological fact, it is obvious that the organs which have not descended are not always defective in structure or function. The cases hitherto observed are so nearly balanced that it is difficult to say whether it is the rule or the exception that crypsorchides should be found prolific; the facts above mentioned clearly prove that there is no reasonable ground for pronouncing them to be absolutely sterile or unprolific, merely because their testicles are not in the scrotum. If with a non-descent of these organs there should be a non-development of the other external organs, and this is accompanied by a total want of the characters of virility, then the person may be regarded as impotent or sterile. The testicles may, in such a case, be either congenitally absent or physically imperfect—a fact only ascertainable by an examination of the body after death. On the other hand, in cases in which there are no external marks of effeminacy, or other grounds for suspecting a want of procreative power, and the person is capable of sexual intercourse, this imperfection does not offer any bar to marriage, nor is it a sufficient ground for divorce. It would not justify a medical man in denying the paternity of a child on a question of affiliation, bastardy, or inheritance; and so long as a power of sexual intercourse existed, it would not justify him in pronouncing a person to be incurably sterile. The capacity for sexual intercourse is the fact to which the English law commonly looks on these occasions. If this exist, then it will hardly entertain the question—surrounded as it may be with conflicting medical opinions—whether, from the mere retention of the organs in the abdomen, the fluid secreted is or is not of a prolific nature. Women may be sterile from a variety of causes affecting the internal organs, only ascertainable after death. The ovaries may be so diseased that no prolific intercourse can take place, although there may be no physical incapacity. In a case related elsewhere, the incapability of *conception* on the part of a woman was held by Lushington not to be a sufficient ground for pronouncing a sentence of nullity of marriage (p. 685, *post*); and doubtless a want of power on the part of a man to effect impregnation, unless it depended on some visible physical defect, would be viewed in a similar light. Such persons are not impotent, but sterile, and sterility in an irremediable form is rather assumed than demonstrated to exist.

The presence of what have been called supernumerary testicles does not affect the virile powers of a person. These have in general been found, by dissection, to be tumours connected with the healthy glands, and not at all adding to or interfering with their functions. Even the presence of two or three penes, according to Mende, is no bar to the exercise of sexual power, provided only one possesses the normal characters of the male organ. (‘Ausführl. Handb. d. Gerichtl. Med.,’ vol. 4, p. 337.) In 1865 a Portuguese youth, aged 19, I. B. dos Santos, was seen by many medical men in London. He was well formed except in reference to the sexual organs. He had two complete and well-formed penes, placed side by side, the right somewhat smaller than the left, and both subject to erection at the same time. He stated that he used the left in sexual intercourse. On the outside of each penis was a scrotum with one testicle fully developed. Between them was a shrunken scrotum which contained two testicles until he was 10 years old, when they ascended into the abdomen. When the bladder acted, urine issued from both penes. An engraving of this remarkable malformation is given with the history of the case in the ‘Lancet,’ 1865, ii. p. 124.

In some instances there is an arrest of development in the external organs; and with this there is generally an absence of sexual desire. Certain diseases of the appendages of the testicles may, however, render a person sterile. The spermatic secretion is commonly suspended in most severe diseases which affect the body. A frequent cause of impotency (sterility) in the adult, when the organs are apparently sound, is spermatorrhœa, arising from abuse or excess. This, however, is remediable to a greater or less extent by treatment. (See Curling, ‘On Diseases of the Testis,’ 2nd edit., p. 386; also ‘Med. Times and

Gaz.,' 1858, i. p. 95.) The incapacity for intercourse in either sex may arise from *extensive disease* affecting parts in and around the organs of generation. The medical opinion here must be regulated entirely by the circumstances attending each case.

On the absence of the penis, as well as on its defective organizations, as causes of incapacity, some remarks have been already made. Sometimes the defect is merely connected with the urethra. Thus the orifice may be on the dorsum penis, and in other cases underneath the organ, so that the urethra may terminate at a variable distance from the glans penis. Those labouring under the former defect are said to have *Epispadia*, and under the latter, *Hypospadia.* Rose describes a case of hypospadia in a child who had been baptized, brought up and educated as a female at a girls' school. The androgynous child was ten years old, diminutive in size, and possessing girlish features. A testicle was recognized on each side, but no distinct penis. ('Obst. Trans.,' 1876, vol. xviii. p. 256.) These beings are often mistaken for girls, but the absence of the function of menstruation is sufficient to remove doubt.

The power to have fruitful intercourse will in either case depend on the situation of the urethral aperture. Some doubt has existed respecting the virile powers of those who are affected with hypospadia; but Rüttel knew an instance of an hypospadian having several children. (Henke's 'Zeitschrift,' 1844, p. 258.) In 1850, a lad, æt. 17, was summoned before the magistrates of Kidderminster on a charge of affiliation, in reference to the pregnancy of a girl, æt. 18. The defence was that he could not be the father of a child, because there was such a malformation of the penis as to prevent prolific intercourse. On examination, the urethra was found to terminate on the under surface of the penis, about an inch and a half from the glans, by a small elliptical orifice, which allowed the urine to pass, but with some difficulty. One medical witness gave it as his opinion that it was not impossible, but highly improbable, that the defendant should possess procreative power; another freely admitted the boy's capacity, and the case was decided against him. ('Med. Times,' 1850, ii. p. 321.) This decision was physiologically correct. When the urine can pass, the seminal fluid can pass; and the only question is, whether the intromission can be such as that the misplaced orifice should come in contact with any part of the vagina or even the vulva. This must depend on the situation of the orifice. (Cases illustrative of the prolific powers of hypospadians will be found in the 'Med. Times,' 1850, ii. p. 292, and 1850, ii. p. 392. An instance of the virility of an hypospadian has also been published in the 'Assoc. Med. Jour.,' 1853, i. p. 236.) Similar remarks apply to epispadians. These malformations are sometimes remediable; but, whether remediable or not, they are not, under any circumstances, to be regarded as absolute causes of impotency.

Impotency from General Disease.—The influence of local disease in affecting virility has been already considered. But there is a class of cases which may come before a practitioner, in which, with well-formed and healthy organs in the male, there will be a state of impotency or incapacity for intercourse. Sometimes this may depend on weakness, or on a want of proper development of the muscular and nervous systems; at other times it may be due to disease of a temporary nature—persisting while the body is still suffering from the disease, and disappearing on recovery. As a converse fact, there are some diseases which appear to bring out the dormant virile powers of persons, or to excite to a higher degree of intensity those which already exist. Thus it is said that in convalescence from fever there is, occasionally, extraordinary salaciousness; but this statement requires confirmation. Again, there are diseases which neither interrupt nor affect the exercise of the sexual functions. As a general rule, diseases which do not affect the brain or spinal marrow, and which are not attended with great bodily debility, do not prevent fruitful intercourse. On the other hand, diseases which are attended or followed by great debility or cerebral exhaustion, suspend or destroy sexual power. Among these may be mentioned water in the chest; general dropsy, especially if attended with effusion in the sexual organs; nervous and malignant fevers which affect the brain; apoplexy, palsy, and other diseases which directly attack the brain or spinal marrow. These last-mentioned diseases probably act by suspending the secretion or altering the nature of the prolific fluid, as well as by preventing that erection of the male organ without which intercourse cannot take place. The sexual function is so intimately allied to bodily vigour and nervous energy that the integrity of the one may be pronounced to be essential to the integrity of the other. Habits of drunkenness and the abuse of alcoholic liquid, tobacco, or opium may give rise to impotency by the injury done to the brain and nervous system. (The reader will find this subject fully discussed by Mende, 'Ausführl. Handb. der Gerichtl. Med.,' vol. 4, p. 349.)

In *Wood* v. *Hotham* (1864), a surgeon was sued for a sum of money for his wife's maintenance. He alleged, in defence, that his wife had been guilty of adultery, and that one of two children born during the marriage was not his. He assigned as a reason for this, that he was so ill at the time that it was impossible he could have had connection with his wife. It appeared, however, that he was then in the habit of sleeping with her, and he was sufficiently strong to go his round of daily visits. The judge, in remarking upon this point, said if such evidence were to be held sufficient proof of illegitimacy, the whole of the law relating to the access and non-access of a husband must be set aside. The jury returned a verdict for the plaintiff.

Diseases and injuries of the spinal cord producing paraplegia have no direct effect on the testicles, but destroy the power to copulate. (Curling, op. cit., p. 371.) When there is a wasting of the testicles, as a result of general paralysis of long standing, there can be no doubt of impotency; but Curling quotes a case from a foreign writer in which, under paralysis (paraplegia) of some years' duration, a man retained sufficient sexual power to have prolific intercourse. When the paralytic person is advanced in age, it is highly probable that he is impotent.

In 1857 a case was referred to the author, in a question of bastardy, for his opinion on a capacity for intercourse under the following circumstances. A woman required an order of affiliation on the putative father of her bastard child. She was a widow, and the illicit connection took place about two months before her husband's death. The husband was at the time 84 years of age; he was bedridden, and for many weeks before his death he could not move in his bed, and was unable to pass his urine without assistance. The medical opinion of those who examined him was that he was impotent from physical infirmity, and in this opinion the author concurred, stating, however, that, unless the male organs were diseased or destroyed, it could not be said that intercourse was impossible. It was, however, wholly improbable that the husband could have been the father of the child.

Blows on the head or spine, by affecting the brain and spinal marrow, may produce impotency. Several cases of impotency from this cause are related by Curling. (Op. cit., p. 362.) It has been noticed that blows on the under and back part of the head, in the region of the cerebellum, have been followed by loss of sexual power on recovery. Sometimes this is temporary; but at other times, when there is wasting of the testicles, it is permanent and irremediable.

Of *moral* causes it is unnecessary to speak. The sexual desire, like other animal passions, is subject to great variation; and there are instances on record in which men, otherwise healthy-looking and healthily formed, have experienced no desires of this kind. They are in a state of natural impotency—a condition which the Canon Law designates as frigidity of constitution. This is not to be discovered by external examination, but rather from their own admission. Under this head we may class some hypochondriacal affections.

Sterility. Definition.—Sterility is usually defined to be 'the inability to procreate, or a want of aptitude in the female for impregnation.' It is not usual to speak of sterility in the male, although there may be procreative incapacity; because the defective condition in this sex, from whatever cause, is, in a legal point of view, included under the term 'impotency' (see p. 668, *ante*). In the strictness of language, a male who has been castrated is sterile; but it is commonly said that he is impotent. Many apparently well-formed males may be sterile without being impotent; *i.e.* they may have intercourse without procreating; for the power of copulating must not be confounded with that of procreation. Curling has pointed out that various causes may render a male sterile, although he may retain a power of sexual intercourse, and thus cannot be regarded as impotent in a legal sense. ('Dis. of the Testis,' edit. 2, p. 216.) Some crypsorchides may be sterile or deficient in procreating power, while at the same time impotency or incapacity for intercourse may not exist. In reference to women, sterility implies that condition in which there is an 'inability to conceive.' This appears to be the true meaning of the term, and the sense in which it is used not only by the best writers but in common phraseology.

Procreative Power in the Female. Puberty.—In the *female*, the procreative power is supposed not to exist until after the commencement of menstruation, and to cease upon the cessation of this periodical secretion. The menstrual function is commonly established in females in this climate between the ages of *fourteen* and *sixteen*; but it may occur much earlier—indeed, in some rare instances, a discharge, resembling the menstrual, has been known to occur in mere infants. ('Lancet,' 1871, i. p. 366.) In other cases, its appearance has been protracted to a much later period. Cohnstein states that the average duration of this function among women, in 400 observed cases, was 31 years. ('Brit. Med. Jour.,' 1873, i. p. 615.) According to Rüttel, the menstrual function appears in the smallest number of females at 12, 13, and 14, and in the largest number at 16, 17, and 18 years. In some it is only first established at from 19 to 21 years; and he states that at this age he has often found the womb small and quite undeveloped. The earliest and latest periods in a large number of cases were respectively 9 and 23 years. ('Lancet,' 1844, ii. p. 283.) Perhaps in this country, the most frequent age for the commencement of menstruation may be taken at 15 years. It is liable to be accelerated in its appearance by certain moral and physical conditions under which a girl may be placed. The most common intervals for its appearance are twenty-eight and twenty-one days. It sometimes does not appear till late in life. Camps found that it had not appeared in a married woman, æt. 30, who had borne no children. ('Lond. Med. Gaz.,' vol. xxxii. p. 409.) Another case is mentioned in the same volume, where it appeared for the first time at the age of 47. So soon as this function commences, a woman may be considered to have acquired procreative power; but a female may conceive before the function has commenced, during the time of its occurrence, or even after it has ceased. From facts elsewhere stated, there is some reason to believe that the period which immediately precedes or follows the discharge is most favourable to conception; although the experience of many accoucheurs has shown that impregnation may take place at any time between one menstruation and another (p. 641, *ante*).

It is important to remember that these changes in the womb may produce remarkable effects by sympathy with the brain and nervous system. At or about the time of puberty, especially if any cause of obstruction exists, some girls are observed to become irritable, easily excited, and they have been known to perpetrate, without motive, crimes of great enormity, such as murder and arson. A propensity to steal is also stated to manifest itself in some cases. (See *post*, Kleptomania.) It has been remarked that acts of arson and murder have been frequently committed by girls at this period of life without any apparent motive or for the most trivial reasons, and the crime has spread by imitation. The case of *Brixey*, tried for the murder of an infant, and acquitted on the ground of insanity, will serve as an illustration of the morbid effect produced on the brain by disordered menstruation. (See *post*, Insanity.) Other cases have been already referred to in this work in which crimes of the greatest magnitude have been traced to girls of this age, but without any apparent ground for imputing actual insanity. The only suggestion that could be advanced in favour of insanity was the atrocity of the act without any of the ordinary motives which actuate criminals, and the fact that the acts of murder had been perpetrated on helpless children incapable of giving offence. In the case of *Vamplew* (Lincoln Aut. Ass., 1862), it was proved that the prisoner, a girl under 13 years of age, acting as nurse in a family, had destroyed with strychnine an infant entrusted to her care. It transpired that in two other families she had previously destroyed, with poison, infants placed under her charge. The case of *Constance Kent*, a girl between 15 and 16 years of age, furnishes another illustration. She was convicted, on her own confession, of the murder of her infant step-brother, under circumstances showing great atrocity and cunning, and for which no motive could at the time be suggested. Lastly, there is the case of the girl *Norman* (p. 456, *ante*), aged 15 years, convicted of an attempt to murder, by suffocation, a child placed under her care as nurse. It came out that three other children to whom she had been nurse had died under her hands from suffocation. There was no evidence of intellectual insanity in any of these cases; nor was there anything to show that the uterine sympathy, if it existed, was beyond the power of self-control. These females were all convicted of the crime of murder. At this period of life, the state of the mind should be closely watched, and any causes of irritation or violent excitement removed. Irregularity, difficulty, or suppression of the menstrual secretion, may give rise to temporary insanity, indicated by taciturnity, melancholia, capricious temper, and other symptoms. Puberty in the *male* may be attended with similar morbid propensities, but these are not so commonly witnessed as in the female.

Pregnancy before Menstruation.—The previous occurrence of menstruation is not indispensable to pregnancy: many cases are on record in which women who have never menstruated have conceived and borne children (p. 509, *ante*). One case is reported in which a woman, æt. 25, became pregnant and bore a child, and menstruation was only regularly established afterwards. ('Lancet,' 1842.) Murphy mentions another instance of pregnancy previous to menstruation in a woman, æt. 23. ('Obst. Rep.,' 1844, p. 7.) Numerous cases of conception without previous menstruation are quoted by Capuron ('Méd. Lég. des Acc.,' p. 96); and no fewer than nine instances of pregnancy before menstruation have been collected by Whitehead. The women were all in excellent health during the whole time, and one did not menstruate until more than two years after the marriage had been consummated. ('On Abortion,' p. 223; see also 'Lond. Med. Gaz.,' vol. xliv. p. 969.) W. Taylor met with an instance in which a girl, æt. 13, bore a child before menstruation had appeared. ('Med. Times and Gaz.,' 1853, i. p. 277; see also for remarks on this subject, 'Edin. Month. Jour.,' 1850, ii. p. 73.) Reid reported a case in which a patient of his bore a child at the age of 17 without having previously menstruated; and he collected from various authorities other cases of pregnancy occurring in women who had not menstruated. ('Lancet,' 1853, ii. p. 296.) Many other cases have been reported in the medical journals; and it is not unlikely that girls not unfrequently anticipate menstruation by becoming pregnant shortly before the advent of the first monthly flow.

Instances of *premature puberty* in the female are now numerous: they are far more common than in the male sex. Whitmore met with the case of a female child who, from a *few days* after birth menstruated regularly, at the periods of three weeks and two or three days, until she had attained the age of 4 years, when she died. On inspection after death, she appeared like a much older girl. The breasts were unusually large, and the female organs and lower limbs were considerably developed. ('North. Jour. Med.,' 1845, ii. p. 70.) Another case is reported in the 'Lancet' (1848, i. p. 137); this was a child aged 3 years. The breasts were as healthily developed as in an adult of 20 years, and the sexual organs were also as much developed as in a girl at the age of puberty. It was observed that this child, who had been regularly menstruating for twelve months, had the appearance of a little old woman. (For other cases of menstruation at 5 years, see 'Lond. Med. Gaz.,' vol. xxv. p. 548; at 3 years, vol. xlvii. p. 244; and at 3½ years, 'Med. Times and Gaz.,' 1858, ii. p. 98; and 'Brit. Med. Jour.,' 1873, ii. p. 666.) A girl, æt. 2, in good health, regularly menstruated in a natural way. Another, æt. 8, also performed the function in the usual way. ('Brit. Med. Jour.,' 1875, ii. p. 514.)

In these instances of early menstruation, there is reason to believe that a procreative power is also early developed; but it is not common to hear of such young females becoming impregnated. A case is mentioned by Beck, in which a girl menstruated at one year; she became pregnant, and was delivered of a child when little more that *ten years* old. Walker met with a case in which the menstrual function was established at the age of 11½ years, and the girl was delivered of a living child when only 12 years and 8 months old. ('Amer. Jour. Med. Sci.,' Oct. 1846, p. 547.) In another, observed by Rüttel, a girl of the age of *fourteen* became pregnant by a boy of the same age. He also quotes three other cases, where one girl at the age of *nine*, and two at the age of *thirteen*, became pregnant. The first of these three cases represents the earliest age for pregnancy yet assigned by any author. In a case of criminal assault on a girl under 12, tried at the Maidstone Winter Assizes, 1878–9 (*Reg.* v. *Dean*), it was proved in evidence that, at the age of 12 years and one month, the girl had been delivered of a full-grown child, which was then living. The prisoner, who was the girl's stepfather, was convicted of the felony. Wilson met with an instance in which a girl, at the age of 13 years and 6 months, gave birth to a full-grown child: conception must have taken place when she was 12 years and 9 months old. ('Edin. Med. Jour.,' 1861, ii. p. 332. See also 'Vierteljahrsschr. für Gerichtl. Med.,' 1863, vol. 1, p. 180.) Robertson mentions the case of a factory-girl who became pregnant in the eleventh year of her age. In another, communicated to the author, a girl menstruated at 10 years and 2 months, and became pregnant when 11 years and 8 months old.

Age at which Menstruation ceases. Menstrual Climacteric.—The average age at which this function ceases in women is usually from 40 to 50 years; but as it may commence early, so it may continue late in life. In one case it has been known to cease at the age of 23, and in other instances it has continued up to the age of 66, and even of 75 years. (Whitehead, op. cit., p. 145, *et seq.*) Royle describes two cases in which menstruation continued up to the age of 67. Thomas met with a case in which a woman had ceased to menstruate at the age of 45, but the discharge suddenly reappeared after an attack of illness when she had reached the age of 69. The discharge appeared several times, but not with monthly periodicity. It seems that her mother and sister had also menstruated at the ages of 69 and 60 respectively. ('Med. Times and Gaz.,' 1852, ii. p. 148.) In a case which occurred to Capuron, it continued beyond the age of 60; but a more remarkable case, both of late menstruation and late pregnancy, is quoted by Orfila from Bernstein. A woman in whom the function appeared at 20, menstruated until her ninety-ninth year. Her first child was born when she was 47, and her seventh and last when she was 60. ('Méd. Lég.,' 4eme edit., 1848, vol. 1, p. 257; see also Briand, 'Man. de Méd. Lég.,' 1846, p. 137.) From these facts, it is clear that it is impossible to fix the age of a woman by the period at which this 'change of life' occurs. At the best, it can only be an average of a certain number of instances.

Other cases are recorded on good authority. Whitehead communicated to the 'Lancet,' 1866, the following facts. He was called to a lady, æt. 77, suffering from uterine hæmorrhage. Upon inquiry, he found that she had menstruated monthly up to the time at which he saw her. The discharge lasted from four to five days, and had then left her; but on this occasion it had been very profuse. She was restored by the usual remedies. Other cases are reported in the 'Amer. Jour. of Med. Sci.' (Jan. 1845, p. 107). In one of these, a nun, the menses ceased at 52; at the age of 62 they reappeared, and so continued regularly, until she was last seen at the age of 73. In another instance, a nun, aged 90, had regularly menstruated from 15 to 52. The menses then ceased, but they reappeared at the age of 60 without pain, and had occurred regularly every month since that date. Her health had been good throughout.

From observations made on 400 women by Cohnstein, it appears that the menstrual function is of the longest duration in women who menstruate early, are married, have more than three children, nurse their children themselves, and cease child-bearing between the ages of 38 and 42. ('Brit. Med. Jour.,' 1873, i. p. 615.)

Is it possible for a Woman to become pregnant after menstruation has ceased?—It is commonly asserted and believed that, after the cessation of menstruation, a woman is sterile. This is doubtless the general rule; but in a medico-legal view it is necessary to take notice of the exceptions. Pearson communicated the case of a lady, æt. 44, who up to Sept. 1836 had given birth to nine children. After this, the menses appeared only slightly at the regular periods until July, 1838, when they entirely ceased. Owing to this, she supposed that she was not liable to become pregnant; but on Dec. 31, 1839—therefore eighteen months after the entire cessation of the menses—she was delivered of her tenth child. Hence conception must have taken place at from eight to nine months after the final cessation of the discharge.

Latest Age for Pregnancy. Fecundity.—As a rule, women rarely conceive after the age of 45. At and beyond this age, they have not often intercourse with young and vigorous men. Menstruation may continue up to 50 and 52 years. The age at which women commonly cease to be impregnated ranges from 45 to 50. It has been observed that, out of 10,000 pregnant women, there were only three above the age of 50 years. ('Ann. d'Hyg.,' 1873, t. 2, p. 150.) Many exceptional instances are, however, recorded of women advanced in life bearing children. A case is reported in which a well-formed woman, who had been married 19 years, did not bear a child until she had reached the age of *fifty*. (Schmidt's 'Jahrb. d. Med.,' 1838, S. 65; Henke's 'Zeitschr.,' 1844, S. 251.) In this case it is stated that menstruation had ceased two years before conception. Rüttel observed in twelve women that they bore their last children at ages varying from 45 to 50 years. Ottinger met with an instance of a woman bearing a child at 50; Cederschjald with another where the woman was *fifty-three*, and menstruation still continued. Haller records two cases in which women at *sixty-three* and *seventy* respectively bore children. (Briand, 'Man. Complet de Méd. Lég.,' p. 137.) But these are doubtful instances, contrary to all modern experience. Neuermann drew up a table in reference to the late ages of life at which women have borne children. Out of 1000 cases in 10,000 births, he found that 436 children were born by females at the ages respectively—

Of 41 years	101	Of 48 years	8
42	113	49	6
43	70	50	9
44	58	52	1
45	43	53	1
46	12	54	1
47	13		

A case was communicated to the 'Lond. Med. Gaz.' (vol. xxxix. p. 950), in which a woman was *fifty-five* years of age when her last child was born; she had menstruated up to that time. Barker, U.S., has found that the retention of this power of child-bearing depends, not so much on the continuance of menstruation, as on the state of the ovaries. These organs usually become atrophied in women between the fortieth and the fiftieth years, but in exceptional cases this change may not take place until from one to four years later. When the ovaries have undergone this senile atrophy, the woman is permanently sterile. He asserts that not a single authenticated instance has been known of a woman over *fifty-five* years of age who has given birth to a child. A woman over fifty-five years may be considered as past the age of child-bearing. ('Med. Times and Gaz.,' 1875, i. p. 186.)

In *Lord* v. *Colvin* (Vice-Chanc. Ct., July, 1859), one of the questions raised was whether a woman, æt. 52, who had been married 30 years without having had children, had then passed the age of child-bearing: her issue, if any, would take the benefit of certain property under a will. It was decided that the woman had not reached an age at which it could be said to be impossible that she might bear children. In a return of the Registrar-General for Scotland (Feb. 1862), it is stated in the Table for Glasgow, that one mother who was only 18 had had four children, one who was 22 had had seven children, and of two who were only 34, the one had had thirteen and the other fourteen children. On the other hand, two women became mothers as late in life as at 51, four at 52, and one mother was registered as having given birth to a child in the 57th year of her age. We cannot, therefore, pretend to fix the age beyond which pregnancy may not occur. Questions of this kind have an important bearing on the subject of legitimacy; and unless the law looks to something more than ordinary professional experience in such matters, the decisions of courts must be inequitable. In two cases, however, it appears to have been assumed that a woman could not bear a child after the age of 53. This was the decision of the Master of the Rolls in *Price* v. *Bousted,* and more recently the decision was followed by Kindersley, V.C., in *Haynes* v. *Haynes* (Feb. 1866). The petition in this case involved the question whether a single lady, aged 53 in Dec. 1865, could be considered as past child-bearing, and it was decided in favour of this assumption. These decisions are not reconcilable with the cases given above. Stolz refers to three cases of married women bearing children at the ages of 45, 48, and 51 respectively. In two of these cases the pregnancy was mistaken for dropsy and treated as such. ('Ann. d'Hyg.,' 1873, t. 2, p. 151.)

Causes of Sterility.—The causes of sterility in the female are very numerous. Some of them depend upon peculiarities of constitution, the sexual organs being well formed and developed; others upon latent changes or congenital defects in the womb and its appendages, only discoverable by an examination after death. Sterility rarely becomes a medical question in contested cases of legitimacy; for a claim on the part of a person to be the offspring of a particular woman, unless she were in collusion with the claimant, could only be made after her death; and if not disproved by medical evidence, showing that the woman could not have borne children, it would in general be easily set aside by circumstances. It may be most important to prove that a woman was in such a bodily condition that she never could have conceived or borne a child. If the womb, ovaries, or other parts were congenitally defective or absent, or if there were external sexual malformation, accompanied by occlusion or obliteration of the vagina, a medical witness could have no difficulty in saying that the woman must have been sterile. ('Med. Times and Gaz.,' 1858, i. p. 96.) A mere occlusion of the vagina, removable by operation, does not necessarily indicate sterility, for the internal parts may be healthy and sound.

Medico-Legal Relations of the Subject. Divorce.—Sexual malformation, involving impotency or sterility, constitutes one of the *canonical* impediments to marriage, and if matrimony be contracted by a party labouring under such malformation, the contract is voidable. The impediment constituting impotency may arise either from malformation, from that which the law calls frigidity of constitution, or any physical cause of whatever nature which may render intercourse impossible. When the physical defect is not apparent, or when it is alleged to be irremediable, a continued cohabitation of three years is required before a suit can be entertained (Ayliff's 'Parergon'); but according to Oughton—'hæc triennalis expectatio non est necessaria ubi statim possit constare de impotentiâ coeundi.' A suit for a sentence of nullity may be promoted by either party, and the medical proof required to found a sentence must be such as to satisfy the court that the incapacity pleaded was in existence at the time of the marriage, and that it still remained without remedy. There should be no delay in instituting the suit, and there should be proof that the impediment was not known to the complaining party at the time of the contract. A longer delay in making the complaint is allowed to a female, without prejudicing her case, than to a male, by reason of the modesty of her sex.

In a suit which came before the Ecclesiastical Courts in 1845, a singular question arose whether, when there was a capacity for sexual intercourse on the part of a woman, with a certainty that from physical defect it could never be prolific, this was sufficient to entitle the husband to a divorce. On the part of the woman it was insisted that, in order to entitle a party to a sentence of divorce, there must be an utter *impossibility* of sexual intercourse. The case, it was argued, was one of mere sterility, which was no ground for a sentence. Lushington, in pronouncing sentence, said that mere incapability of *conception* is not a sufficient ground whereon to found a decree of nullity. The only question is, whether a female is or is not capable of sexual intercourse; or, if at present incapacitated, whether that incapacity admits of removal. A power of sexual intercourse is necessary to constitute legally the marriage-bond, and this intercourse must be ordinary and complete, not partial and imperfect; yet it would not be proper to say that every degree of imperfection would deprive it of its natural character. If it be so imperfect as to be scarcely natural, it is, legally speaking, no intercourse at all. As to conception, there is no doubt that the malformation is incurable. If there was a reasonable probability that the female could be made capable of natural coitus, the marriage could not be pronounced void; if she could not be made capable of more than an incipient, imperfect, and unnatural coitus, then it would be void.

It appears that, in order to justify a decree of divorce on the ground of impotency or sterility, the impediment to intercourse or procreation should be established by good medical evidence, and it must be *apparent* and *irremediable*; it must also have existed before the marriage of the parties, and have been entirely unknown to the person suing for the divorce; if it has supervened after the marriage, this is no ground for a suit. (See, however, p. 687, *post.*) The nature of the impediment is to be determined by private medical opinions or affidavits, based on an examination of *both* parties. Such an examination must be voluntary on the part of the man or the woman. The judge of the court cannot order it against the wish of the party. All that he can do is to decide in the absence of evidence of the kind, and this may be adverse to the party refusing. In the case of *Hewitt* v. *Pery* (Divorce Ct., July, 1873), a suit for nullity, Hannen, J., gave his decision in favour of the husband and against the wife. She refused to submit to an examination, and abstained from presenting herself as a witness in the case. The case was remarkable in other respects. The evidence of the husband was to the effect that there had been more than three years' cohabitation, but no consummation of the marriage. There was no structural impediment in the way of consummation in the wife's person; but whenever an attempt at intercourse was made, it brought on an attack of hysteria, and this rendered it practically impossible. A decree *nisi* for annulling the marriage was granted to the husband; but the judge at the same time observed that such a decree could only be granted on the ground that there was a *physical* difficulty. Thus it must not be merely a wilful refusal on the part of the wife. This alone would not justify legal interference; it must be shown, as in this case, that injury may be done to health by inducing an attack of hysteria or other disorder. Oldham has informed the author that several cases of this kind have come before him. It may be regarded as incapacity, not from structural defect, but from a general disturbance to the system induced by the attempts at intercourse. In one instance that came under the editor's notice, consummation of the marriage was long delayed in consequence of the hysterical condition of the woman. The difficulty was at length overcome by the administration of ether vapour. She recovered consciousness during the act of coitus, and there was no subsequent difficulty in intercourse.

St. Clair Gray pointed out another condition in a woman which may prevent consummation of a marriage and give rise to a suit of nullity. This has been called *Vaginismus.* In this disease there is a peculiarly sensitive state of parts, whereby, 'from excessive nervous irritability of the vagina,' any attempt at sexual intercourse, or even any pressure made in the vicinity, causes intolerable pain to the woman. He describes three cases which have fallen under his notice. In one, a woman, æt. 38, had been married thirteen years, but, in consequence of the intolerable pain produced, her husband had not been able to have intercourse with her. An examination showed that the hymen was persistent, but the parts were so highly sensitive that a touch with the finger only produced great suffering. Nine years passed without any change in her condition. In two other cases of married women there was a similar state of parts, the hymen being also persistent in both. One had been married four, and the other seven, years, and they had had no children. The hymen was destroyed by operation; the sensibility of the parts disappeared; and one gave birth to four, and the other to three, children. ('Glasgow

Med. Jour.,' May, 1873.) It is clear, therefore, that vaginismus would be no legal ground for divorce according to the law of England, because the defect is remediable—a fact proved by two of the cases described. In the three cases, the women laboured under no physical malformation. They were in every respect healthy and well-formed.

There is one remarkable circumstance with respect to these suits of nullity; namely, that, in nearly all of them, the suit is by the woman against the man; although there is no reason whatever to suppose that impotency and sexual malformation are more common in males than malformation and sterility in females. We rarely hear of a husband instituting a suit of divorce on the ground of sterility (incapacity of procreation) in the wife; it is, in most instances, the wife that promotes the suit on the ground of impotency or incapacity of intercourse in the husband. The difficulty of establishing incapacity in the female, and the facility of proving impotency from physical causes in the male, may probably account for this difference. Suits of this kind are sometimes instituted many months and years after the union of the persons; but it is probable that the desire for separation in such cases often depends on some cause which the law would not recognize as sufficient of itself, while it would admit a plea of impotency. The French law applies the principle of condonation to such cases, so that no suit for nullity of marriage can be entertained, if cohabitation has continued for six months after the discovery of the personal defect. The laws of England and France differ in reference to personal defects. Impotency or incapacity of intercourse in a woman is, in England, a sufficient ground for annulling the contract; but not so in France. Tardieu states that the law has not placed impotency in the female among the causes for nullity of marriage. ('Ann. d'Hyg.,' 1872, t. 2, pp. 153, 155.)

Braxton Hicks ('Lancet,' 1885, ii. p. 198) gives interesting cases of successful suits for nullity: one on account of the frigidity of the wife; and another on account of the incompetence of the husband, he having lived with his wife for two years without once attempting intercourse. He also relates an unusual case of post-nuptial insanity supervening on the wedding night from sexual difficulties on both sides. The woman recovered, and bore several children to her husband.

The validity of a marriage cannot be disputed, on the ground of physical incapacity, after the death of one of the parties. The incapacity does not render a marriage void, but only voidable. It is a matter purely of personal complaint or grievance. Third parties cannot be admitted to institute a suit of nullity after the death of husband or wife. In an administration suit, July, 1868, the plaintiff claimed as the lawful husband of the intestate. The defendants, who were her next of kin, alleged that the plaintiff was not her lawful husband, on the ground of physical incapacity, and that the marriage had never been consummated. Wilde, J., delivered judgment against the defendants, saying that the suit of nullity was a personal one, and as this had not been instituted during the life of the woman, the validity of the marriage could not now be contested.

In treating of sexual identity, Tardieu remarks that marriage implies the lawful union of a man and woman; that such a contract cannot be entered into except between persons who are of different sexes. When the sex is disputed, the doubt can be removed only by an anatomical and physiological examination of the person. The intervention of a medical expert is indispensable in such a case, and the object of such intervention is perfectly defined. The problem for solution may be stated in these simple terms: Is the person married as a woman—a malformed woman—impotent and incapable of sexual intercourse? In this case, according to the strict interpretation of the law of France, there is no ground for nullity of marriage. Is the person a malformed man, presenting some doubtful appearances of the female sex? In this case there has been no legal marriage. It is null *ab initio.* Assuming that there are no beings entirely deprived of sex, there may be cases, although rare, in which a mixture of the organs of the two sexes may be found in the same person. Such a being is incapable of entering into the marriage contract, since, whatever may be the sex of the person with whom the contract is made, there must be identity of sex, and therefore nullity of marriage.

Insanity, if existent at the date of marriage, is a ground for instituting a suit of nullity. (*Hunter* v. *Hunter,* otherwise *Edney.*) When not clearly developed on the day of marriage, the suit will fail. (*Durham* v. *Durham,* otherwise *Milner,* Prob. Ct., Feb. 1885; *Cannon* v. *Cannon,* otherwise *Smalley,* Prob. Ct., March, 1885.)

RAPE.

CHAPTER 59.

SOURCES OF MEDICAL EVIDENCE.—RAPE ON INFANTS AND CHILDREN.—MARKS OF VIOLENCE.—PURULENT DISCHARGES FROM THE VAGINA.—EVIDENCE FROM GONORRHŒA AND SYPHILIS.—RAPE ON GIRLS AFTER PUBERTY.—DEFLORATION.—SIGNS OF VIRGINITY.

Rape is defined in law to be the carnal knowledge of a woman by force, and against her will. Medical evidence is commonly required to support a charge of rape, but it is seldom more than corroborative; the facts are, in general, sufficiently apparent from the statement of the prosecutrix. There is, however, one case in which medical evidence is of some importance—namely, when a false accusation is made. In some instances, as in respect to rape on infants and children, the charge may be founded on mistake; but in others there is little doubt that it is often wilfully and designedly made for motives into which it is here unnecessary to inquire. Amos remarked that for one real rape tried on the circuits, there were on the average twelve pretended cases; and common experience bears out this statement. In some few instances, these false charges are at once set aside by medical evidence; in others, medical men may be sometimes the dupes of designing persons; but in the majority, the falsehood of the charge is proved by inconsistencies in the statement of the prosecutrix herself. In Scotland, where there is a public prosecutor, and a careful preliminary inquiry, false charges of rape are said to be exceedingly rare. The *consent* of the girl does not excuse or alter the nature of the crime when she is under thirteen years of age, since consent at this period of life is invalid; and the carnal knowledge of such a girl is rape in law, and is a felony by the 48 & 49 Vict., c. 69. An attempt at carnal knowledge is a misdemeanour. Even the solicitation of the act on the part of a child does not excuse it. A man who carnally knows, or attempts to know, any girl above the age of thirteen, and under the age of sixteen years, even if she consents, is guilty of a misdemeanour.

The duty of a medical witness on these occasions is very simple; and perhaps this will be best understood by considering the subject in relation to females at different ages. On being called to examine a person on whom a rape is alleged to have been committed, the first circumstance which a practitioner should notice is the precise *time* and date at which he is summoned, taking an early opportunity of comparing his watch with some neighbouring clock. This may appear a trivial matter, and one wholly irrelevant to the duties of a medical practitioner; but it is to be observed that the time at which a surgeon is required to examine a woman may form a material part of the subsequent inquiry. It will be highly important to the defence of a person accused, if it can be proved that the female did not take the earliest opportunity to complain; and it may be also the means of defeating an *alibi* falsely set up for the defence. Medical evidence in cases of rape may be derived from four sources:—1. Marks of violence about the genitals. 2. Marks of violence on the person of the complainant or prisoner. 3. The presence of stains of the spermatic fluid or of blood on the clothes of the complainant or prisoner. 4. The existence of gonorrhœa or syphilis in one or both. This evidence will vary according to the age of the female and other circumstances.

RAPE ON INFANTS AND CHILDREN.

The sexual organs should in these cases present marks of injury if the crime has been completed, and there has been *any resistance on the part of the child;* for it is impossible to conceive that forcible intercourse should take place without the production of ecchymosis, the effusion of blood, or a laceration of the pudendum. Even without reference to manual violence on the part of the adult assailant, the size of the male organ must generally cause much local injury in the attempt to enter the vagina of a child. If the violation has taken place within two or three days, the appearances presented by the parts may be as follows:—1. Inflammation, with more or less abrasion of the lining membrane. 2. A muco-purulent discharge from the vagina of a ropy consistency, and of a yellowish or greenish-yellow colour, staining and stiffening the linen worn by the girl; the mucous membrane of the urethra is inflamed, rendering the discharge of urine painful. 3. In recent cases, blood may be oozing from the abraded membrane, or clots of blood may be found deposited in the vulva. 4. The hymen may be entirely destroyed, or (what is more commonly observed) it may present on careful examination one or more slight lacerations. Owing to the inflamed state of the parts, the proper examination of the hymen is rendered difficult—any attempt to separate the thighs for this purpose causing great pain. For this reason also, the child walks with difficulty, and complains of pain in walking. 5. Lastly, the vagina may be unnaturally dilated.

It has been propounded as a serious question whether a rape can be perpetrated on children of tender age by an adult man; and medical witnesses at trials have adopted conflicting opinions. Some are inclined to regard all such charges as unfounded, and to seek for other medical explanations of the symptoms above described. This practice has been carried of late years to an undue extent, simply because many of these charges have been proved to be false; but common experience, supported as it is by the accurate observations of Casper, shows that there is too frequently a real foundation for the charge in reference to children, and that a girl is not to be discredited merely because of her tender age. This would be conferring impunity on the acts of a vile class of offenders. In all cases there should be good medical evidence and a corroboration from circumstances. There is a deplorable vulgar error, causing this crime to be a frequent one. It is this, that gonorrhœa and syphilis in the male are cured by coitus with a female who is a virgin. It need hardly be said that this superstition has no medical basis. In 1884, a case was tried at Liverpool, in which Lowndes gave evidence that in this way a man had inoculated a young girl with syphilis.

For the *legal* establishment of the crime, proof of penetration only is demanded, and a sufficient degree of penetration to constitute rape in law may take place without necessarily rupturing the hymen. There must be medical evidence to show that, in a special case, there was actual penetration—the degree of penetration being quite immaterial. It is true that there could not be a complete introduction of the adult male organ into the vagina of a child without a rupture or laceration of the soft parts; but the absence of such marks of violence would not justify a medical witness in denying the perpetration of the crime, since the law does not require proof either of a complete or of a violent introduction. It has been decided that penetration to the vulva alone is sufficient to constitute this crime. Medical men have sometimes fallen into an error on this point, considering that, when the hymen was entire, rape could not have been committed; but the Statute Law says nothing about the rupture of the hymen as a necessary part of the medical evidence; it merely requires from the medical witness proof of vulval penetration,—this may occur and the hymen remain intact. In *Reg.* v. *Harris* (Bristol Lent Ass., 1873), the prisoner, an adult, was convicted of rape on an infant only *seven months* old. According to the medical evidence, there was no great amount of violence to the genital organs. The parts were swollen, and there was slight excoriation about the labia minora, with a small discharge of blood. The hymen and the vagina had escaped laceration. Seminal fluid was found on the person of the child. In this case there might have been penetration of the male organ to the vulva. In so young a child there could have been no resistance, and the act might therefore have been perpetrated without leaving any serious marks of violence.

In Scotland, this question came formally before the judges in the case of *Macrae* (High Ct. of Just., 1841). It was insisted by the prisoner's counsel that there should be proof of full and complete penetration; and there was no sufficient evidence to show that penetration had taken place into the canal of the vagina beyond the vulva. Lord Meadowbank charged the jury to the effect that the evidence of the prisoner's guilt was complete; that scientific and anatomical distinctions as to where the vagina commenced were worthless in a charge of rape; and that, by the law of Scotland, it was enough if the woman's body was entered. In a case like this, where there was no evidence of emission, and the girl was young, he did not consider it necessary to show to what extent penetration of the parts had taken place, or to prove that it had gone either past the hymen, into what was anatomically called the hymen, or even so far only as to touch the hymen. The prisoner was convicted. ('Cormack's Edin. Jour.,' 1846, p. 48.) Up to the date of the case of *Macrae,* it had been the practice with the Scotch judges to require proof of *full* and *complete* penetration. (See on this question a paper by Easton, 'Glasgow Med. Jour.,' 1859, p. 129.)

Marks of Violence on the Pudendum.—When there are no marks of violence or physical injury about the pudendum of a child, whether because none originally existed, or they existed and had disappeared in the course of time, a medical witness must leave the proof of rape to others. He can only answer questions of possibility or probability, according to the special facts proved. It is, however, in all cases his duty to be guarded in giving an opinion that a rape has been perpetrated, when there is a total absence of marks of violence on the genitals. It is true that rape in a legal sense may be perpetrated without necessarily producing such marks on a child; but then the proof of the crime will not depend on *medical evidence* only. The absence of marks of violence on the genitals, when an early examination has been made, furnishes a strong presumption that rape has *not* been committed on these young persons. It is obvious that a false charge might be easily made and sustained, if medical opinions were hastily given on the statements of a mother and child, when there was no physical appearance to corroborate the accusation. (See on this subject a paper by Toulmouche, 'Ann. d'Hyg.,' 1864, t. 2, p. 338.)

Supposing at the period of examination no marks exist, it may be necessary to consider whether there has been time for them to disappear after the alleged perpetration of the offence; but in such cases it is rarely in the power of a medical witness to express an affirmative opinion of the perpetration of the crime: he should leave this to be proved by the general and circumstantial evidence. Casper met with a case in which a man, æt. 37, committed a rape on a girl only eight years of age: he was seen in the act, and defended himself on the plea of drunkenness. The girl was examined by a medical man on the day following,—the labia were then reddened, and there was an injection of the membrane at the entrance of the vagina, which was very sensitive. As an illustration of the rapidity with which the marks of rape disappear in young children, when not attended with great physical injury, it may be stated that this girl was carefully examined by Casper *eleven days* after the assault. The sexual organs were then in their natural state; there was not the least appearance of local injury, and no inference could have been drawn at this date that the girl had been subjected to any violence. Medical practitioners are not always sufficiently careful in the inferences which they draw from an examination of children at distant periods after an alleged rape. They allow themselves to be deceived by a plausible story, apparently consistent, and thus see, or think they see, proofs of rape on examining the sexual organs of a girl weeks after the alleged perpetration of the crime; whereas, had the girl been brought before them as a casual patient, and no suggestion of violent intercourse had been made, they would have probably ridiculed the idea of basing a charge of rape on so slender a foundation. The delay in having the examination made, unless satisfactorily explained, is in itself always a suspicious circumstance. In one case, a medical man gave evidence that a rape had been committed on a girl seven years of age, although he did not examine her until *six weeks* had elapsed from the date assigned by the parents for the alleged perpetration of the crime.

On the other hand, when marks of violence on the genitals are present, they must not be hastily assumed as furnishing proofs of rape; for cases are recorded in which such injuries have been purposely produced on young children by women, as a foundation for false charges against persons with a view of extorting money. The proof or disproof of facts of this kind must rest more upon general than on medical evidence, unless the injuries obviously indicate the use of some weapon or instrument. It should be remembered that the hymen is not always present in young children; it may be, according to some, congenitally deficient, or, what is more probable, it may have been destroyed by ulceration or suppurative inflammation of the parts—a disease to which female infants of a scrofulous habit are very subject. The mere absence of this membrane, therefore, can afford no proof of the perpetration of the crime, unless we find traces of its having been recently torn by violence. Other and more important deductions may, however, be drawn from the presence of severe injuries on the genitals, *i.e.* of rupture or laceration of the vagina or perinæum. It is difficult to obtain accurate medical reports of these cases as they occur in England; but it is quite clear that the male organ may produce much physical injury, whether the child does or does not resist the attempt. ('Vierteljahrsschr. für Gerichtl. Med.,' 1863, p. 337.) A youth was convicted of murder at Chelmsford in 1874. He had committed rape on a girl with so much violence as to cause her death. It was found that the rectum and part of the intestines had been forced out in the act of intercourse, which, according to the confession of the prisoner, had taken place after death. Chevers, in referring to Indian experience, says that in a large proportion of rapes on children, it was very clearly proved that rather severe injuries had been inflicted on them. In the 'Nizamut Adawlut Reports' (1853–5), there are several instances recorded in which the vagina was lacerated. Out of 66 trials for rape, there were 25 convictions: and in one-half of these, the females were under the age of *twelve* years. In one case of a girl, æt. 12, there was a rupture of the lower part of the vagina to the extent of half an inch. In another, a child of six, but apparently much younger, had suffered, as a result of rape, from rupture of the hymen and laceration of the perinæum and vagina. In one instance, the violence proved fatal. ('Med. Jurispr. for India,' p. 468.) When it is alleged that injuries have been intentionally produced on the genitals of a child by mechanical means, with a view of extorting money in laying a false charge of rape, the medical evidence can do no more than show that a girl with such appearances about her sexual organs has suffered from some violence applied to the parts, but whether by the human member, or any other physical means, it would be impossible to say.

In 1840, Brady communicated a case of alleged rape on a female infant only eleven months old, in which the violence done to the genitals proved fatal. In 1858, a girl seven years old was brought into Guy's Hospital, owing to injuries resulting from a perpetration of rape by a boy under seventeen years of age, about half an hour after the occurrence. There was a complete destruction of the hymen, with a laceration of about one-eighth of an inch extending into the perinæum. There had been profuse bleeding. There was then no complaint of pain, and there were no scratches or marks of violence on any part of the body. There was no discharge of a purulent kind. The child was of a scrofulous habit; but she was not suffering from vaginitis, and appeared in other respects perfectly healthy. Forty-eight hours after the occurrence the bleeding had ceased, and the extent of the lacerations was very perceptible. There was no discharge of any kind from the vagina, and no inflamed or swollen condition of the parts. The boy was examined about an hour after the perpetration of the rape, and, although he had been under strict custody, and had had no opportunity of changing his clothes, there was *no blood* found about his private parts or on his clothing. It is probable, as the boy was interrupted in the act by the screaming of the girl, that he suddenly withdrew after having caused the laceration, and that the bleeding was an after-effect of oozing from the ruptured vessels. This is an important fact, because, had not the circumstances been known, the absence of blood on his person might have been construed into a strong proof of innocence. Sawyer met with a case in which a rape was committed on a girl, æt. 5. There was a bruised and swollen state of the genitals; the hymen was not ruptured, and there was no laceration of parts. In spite of this, a large amount of blood had been lost. This bleeding, in his opinion, took place from the hymen, which was in a highly congested state. The man who had perpetrated the crime was examined soon afterwards, but no appearance of blood was found on his organs; there were a few stains only on the front of his clothing. ('New Orleans Med. Gaz.,' 1858, p. 283.) A case occurred to Sells, in 1863, in which he found, on the person of a girl said to have been violated, laceration of the hymen, a clot of blood recently effused lying on the vulva, and the thighs of the child smeared with blood, quite fresh; there was also blood on the sheets of the child's bed. The next morning he examined the accused, but he could find no trace of blood upon him or on the clothing which he wore at the time of the alleged assault. In this case, as there was a failure of identity, the accused was discharged.

Sometimes, owing to the violence used, the parts are much lacerated; and inflammation, followed by sloughing or mortification, may set in and destroy life, especially in children of an unhealthy habit. Care should be taken that the symptoms of a malignant form of disease (*noma*), to which female children when in a dirty or neglected state are liable, are not mistaken for the results of criminal violence. Some such cases are reported, from which it would appear that men have narrowly escaped conviction for a crime which had really not been perpetrated. Percival ('Med. Ethics,' 3rd edit., 1849, p. 117) relates a case which has been the subject of frequent quotation and comment in reference to false charges of rape. A girl, æt. 4, was admitted into the Manchester Infirmary in 1791, on account of a mortification of the female organs and general depression of strength. She had been in bed with a boy fourteen years old, and it was supposed that he had taken criminal liberties with her. The mortification increased, and the child died. The boy was tried on a charge of rape, but acquitted on evidence being adduced that several instances of a similar disease had appeared among girls about the same period of time, in which there was no reason to suspect injury or guilt. In one of these cases there was typhus fever, with a mortification of the genitals. There was no cause of death discoverable on inspection; the lumbar glands were of a dark colour, but all the viscera were sound. This case, with the whole of Kinder Wood's paper on the subject, has been republished by Kesteven. ('Med. Times and Gaz.,' 1859, i. pp. 443.) A case of this disease (*noma pudendi*), but in which no charge of rape was made, was referred to the author in 1865. E. A. R., a girl, æt. 5, died suddenly under circumstances which led to a suspicion that poison had been administered to her. There was congestion of the lining membrane of the stomach, but no poison was found in the body, and there was no trace of the action of poison. When the body was inspected, the genitals externally and the skin around and beyond the anus were intensely inflamed, swollen, and ulcerated, and in an approaching state of gangrene or slough. The hymen at the entrance was ruptured, and the lining membrane of the vagina and womb was highly inflamed —of a dark purple colour, with softening and disorganization of substance. The inguinal glands were enlarged on both sides. The child was in a neglected and dirty state, and died from exhaustion produced by the disease and want of proper food and support. The deceased was seen by a medical man shortly before her death, and the state of the genitals was only discovered by accident, the mother having made no observation about it. When questioned on the subject, she said the girl had been blown down about a fortnight before, and had injured herself by falling on some thorns. This was quite inadequate to account for the condition of the parts. There was no doubt that this was a case of noma rendered fatal by neglect in an unhealthy child. Had any man been seen noticing this child, a charge of rape might easily have been founded upon the state of the genital organs.

On the other hand, fatal injury may be done to these organs in criminal assaults. Colles has reported a case in which a rape was committed by an adult on a child eight years old; it terminated fatally from peritonitis, as a result of the violence, six days after the assault. The child stated that the accused had had forcible connection with her, causing much pain and loss of blood. There were no marks of violence externally, but the orifice of the vagina was lacerated in its entire circumference, and the perinæum was nearly torn through. It was found, on inspection, that the orifice, as well as the whole of the vagina, was in a state of gangrene, and its posterior wall had been lacerated at its line of junction with the womb to the extent of an inch. There was no ulceration; the labia and clitoris had not undergone any change. ('Med. Times and Gaz.,' 1860, i. p. 560.) The prisoner subsequently confessed his guilt. A case communicated by M'Kinlay ('Glasgow Med. Jour.,' 1859, p. 140) proves that extensive injuries may be produced on a child by the act of violation. The girl in this instance was about six years of age, and very intelligent. From her description of the assault, it appears that she fainted, probably owing to the severity of the pain. When examined, it was found that the vagina was ruptured in various directions. One laceration extended from the lower part downwards, dividing the recto-vaginal septum and perinæum down to the verge of the anus. There was a lacerated opening in the coats of the rectum; the orifice of the vagina was lacerated upwards as well as laterally; the parts were raw, swollen, and very tender. When the child was first seen, there was blood on the limbs and clothes. She recovered from these serious injuries in about two months. In one case of alleged rape, it was a question raised in favour of the prisoner, whether rupture of the perinæum could or could not be produced in rape on a girl. Some eminent members of the profession appear to have doubted the possibility of a rupture being produced under these circumstances ('Dub. Med. Jour.,' 1859, p. 53); but the facts here recorded show that such an opinion is erroneous.

Purulent Discharge from the Vagina. Vaginitis. Infantile Leu-

corrhœa.—The existence of a purulent discharge from the vagina as a result of inflammation of the vagina, has been frequently adduced as a sign of rape in girls. The parents, or other ignorant persons who examine the child, often look upon this disease as a positive proof of impure intercourse; and perhaps lay a charge against an innocent person, who may have been observed to take particular notice of the child. A purulent discharge with aphthous ulceration of the mucous membrane is occasionally a result of vaginitis, or inflammation of the vagina. It may arise from dentition, or local causes of irritation —as worms or uncleanly habits—and is observed especially in children of a scrofulous habit. It is frequently met with in girls up to six or seven years of age; and children thus affected have been tutored to lay imputations against innocent persons for the purpose of extorting money. This state may commonly be distinguished from the effects of violence, either by the hymen being entire, or by the non-dilatation or laceration of the vagina or perinæum, by the red and inflammatory condition of the mucous membrane, and the abundance of the purulent discharge, which is commonly much greater than that which takes place as a mere result of violence. Capuron mentions two cases in which charges of rape on children were falsely made against innocent persons, on account of the existence of a purulent discharge, the nature of which had been mistaken. ('Méd. Lég. des Accouchemens,' p. 41.) Locock observed that the purulent discharges of female children were attended with redness and swelling of the sexual organs, and were sometimes accompanied with excoriation and sloughing of the skin, owing to the irritating nature of the matter. They are so connected with dentition that they not only appear with the first and second set of teeth, but even when the wisdom-teeth are irritating the system at a mature age. South, commenting on this statement ('Chelius's Surgery,' vol. i. p. 161), justly remarks that a knowledge of these facts 'is highly necessary, and is very properly insisted on, as there is no doubt that many men have suffered capital punishment from the ignorance of practitioners on this point; and even now, with our better knowledge, it is by no means unfrequent to hear of medical men giving a decided opinion which is almost certainly erroneous upon the gonorrhœal character of pudendal discharges, and thus jeopardizing the character, if not the life, of an innocent man. In giving his opinion or evidence in such cases, a practitioner is bound to speak with extreme caution, and only on the most incontestible proof (which by a mere examination of parts it is almost impossible for him to attain), before he makes a positive statement as to the gonorrhœal character of a discharge.' Although the facts are or ought to be well known to medical men, there is still much popular ignorance in reference to this disease, and false charges of rape on children are now not unfrequently made. Kesteven met with a case in which a discharge from the vagina of a child nine years of age was supposed by the parents to prove that intercourse had been had with her. There was no mark of contusion or violence on or about the pudendum or in the vagina, and the case was very properly pronounced by him to be one of vaginitis. ('Lond.

Med. Gaz.,' vol. xlvii. p. 372.) A similar case was referred to the author, in which a soldier was supposed to have infected a child; but an investigation showed that it was a purulent discharge depending on inflammation of the vagina. The author was consulted in reference to a charge against a father for criminal intercourse with two of his daughters, one of them nine and the other fourteen years of age. If the purulent discharges were gonorrhœal, there was a strong presumption of his guilt; if only of the ordinary kind, arising from vaginitis, he might be innocent, and the accusation made against him false. (See also 'Ann. d'Hyg.,' 1864, t. 2, p. 333; and 1860, t. 2, pp. 131, 345.)

A gonorrhœal discharge is generally very profuse—much more profuse than that purulent discharge which is simply the result of such violence as is produced in the commission of rape. There is another fact worthy of notice, namely, that the last-mentioned discharge, besides being less profuse, lasts for a much shorter time. Casper has recommended that in doubtful cases another examination of the sexual organs should be made in ten or twelve days. If the purulent discharge has then ceased or is ceasing, there is good reason to believe that it was not the result of gonorrhœa, but of some temporary cause of inflammation in the mucous membrane. ('Klin. Novellen,' 1863, p. 10.) Of false charges of rape arising from mistakes on this subject, Casper furnishes various instances. The power of distinguishing gonorrhœal or syphilitic discharges from ordinary purulent discharges has been much debated, and Henry Lee has especially called the attention of the profession to this subject. In a case which occurred under his own observation, a free purulent discharge from the vagina, with a reddened and inflamed mucous membrane, led him to believe that it was derived from gonorrhœal infection; but a week afterwards the inflammation had disappeared, the mucous membrane was of its usual colour, and the discharge not more than natural. This caused him to reverse his opinion, and to congratulate himself that he had not unjustly accused the patient. ('Lancet,' 1873, i. p. 218.)

Assuming that the surgeon is satisfied, from a careful examination, that the purulent discharge must have existed before the alleged assault, and that it is of the ordinary inflammatory character with which young girls are liable to be attacked, this would not justify him in affirming that no rape had been attempted or perpetrated on the child. Girls labouring under this disease may be the subjects of rape, and it will then be necessary to seek for further evidence in the condition of the hymen, the lining membrane of the vagina, and the vulva. If nothing is found beyond what is consistent with disease, there is an absence of medical evidence to prove that any rape has been committed. An aphthous state of the membrane of the vagina must not, under these circumstances, be ascribed to injury caused by mechanical violence. (Casper's 'Gerichtl. Med.,' vol. 2, p. 148.)

Infantile leucorrhœa has been fully investigated by Wilde ('Medico-Legal Observations, etc.,' 1853), and he has collected numerous instances illustrating the great danger to which innocent persons are exposed by reason of false charges of rape on children. Two of these are especially noticed in his essay. A charge was raised against a respectable man, that he had had intercourse with, and produced disease in, two children. The day and hour were circumstantially given, extorted as it appears from the children by their parent, and the man was put upon his trial. The appearances were such as are usual in these cases—a purulent discharge from the vagina with some excoriation, but no bruise, laceration, or mark of violence on the pudendum. There had not been any penetration of the vagina. The charge against the prisoner, although unsupported by any affirmative circumstances, received some strength from the admission made by one medical witness for the prosecution, namely, that the appearances *might* have been the result of violence, and that the discharge *might* have been produced by friction with the member of a healthy man. (Wilde, op. cit., p. 14.) It was proved that the prisoner was not affected either with gonorrhœa or syphilis. Geoghegan, Churchill, and other medical witnesses of repute, gave testimony to the effect that the child was really labouring under an ordinary form of disease, and that there was no medical indication that it had been subjected to any kind of violence. This testimony was not considered by the court to furnish a complete answer to the charge, since it was inferred that the appearances on the child *might* have been caused by the accused, without any marks of violence being left on the pudendum. So strong was this feeling that, had the case rested here, it is probable the accused would have been convicted upon the unsupported statement of the child. An *alibi* was, however, clearly proved, and the man was acquitted. In this instance, it will be perceived it was alleged that a man who laboured under no disease had caused a purulent discharge in a child. At the same time, it was admitted that the pudendum had sustained no violence whatever. Medically speaking, there appears to have been not the slightest pretence for charging the accused with the perpetration of rape; the appearances might have or might *not* have been caused in the manner suggested.

If the child is really labouring under *syphilis* or *gonorrhœa*, this is presumptive evidence of impure intercourse, either with the ravisher or some other person; but we should be well assured, before giving an opinion, that the discharge is really of a gonorrhœal and not simply of a common inflammatory (purulent) character. The party accused may have been at the time free from the disease, or, if labouring under it, then we should expect to find that the discharge had suddenly made its appearance in the child, with its usual severe symptoms, on the third to the eighth day after the alleged intercourse. When these conditions do not exist, it is extremely difficult to form a medical opinion on the subject; since there are no certain means, by the microscope or otherwise, of distinguishing common purulent discharges from those which are gonorrhœal or syphilitic. A case occurred to Biessy, in which a merely mucous discharge in a girl was pronounced to be syphilitic, and the person who was falsely accused.

of rape narrowly escaped conviction. (Briand, 'Man. de Méd. Lég.,' 1846, p. 81.)

We should further distinctly satisfy ourselves that gonorrhœa in a child, if it exist, could not have arisen from infection by any accident irrespective of intercourse. This limitation is rendered necessary by the publication of a report of two cases by Ryan ('Lond. Med. Gaz.,' vol. xlvii. p. 744), in which two sisters, one of one year and the other of four years of age, received the infection by reason of their being washed in a vessel of water with a sponge used by a young woman affected with profuse gonorrhœal discharge. Ryan clearly traced the origin of the discharge to this accident. Had an accusation of rape been made against a man labouring under gonorrhœa, it is not at all improbable that this condition of the children, resulting from an unsuspected accident, would have been taken as a proof of his guilt. Cases of this kind convey an important caution to medical witnesses; *i.e.* that they should not infer criminal intercourse merely from the existence of a gonorrhœal discharge, in the absence of marks of violence to the genitals or of other strong corroborative proofs.

As a summary of these remarks with respect to purulent discharges, we may observe that they should not be admitted as furnishing corroborative evidence of rape, except—first, when the accused person is labouring under gonorrhœal discharge; second, when the date of its appearance in a child is from the third to the eighth day after the alleged intercourse; and third, when it has been satisfactorily established that the child had not suffered from any such discharge previously to the assault. It may be said, however, that all these conditions may exist, and yet the accused be innocent; for a child may, either through mistake or design, accuse an innocent person. This, however, removes the case entirely from the hands of a medical jurist. (The reader will find much useful information on this subject in 'Ann. d'Hyg.,' 1860, t. 2, pp. 130, 345.)

With respect to marks of violence on the *body* of a child, these are seldom met with, because no resistance is commonly made by mere children. Bruises or contusions may occasionally, however, be found on the legs.

If carnal intercourse be had with the consent of a female between the ages of thirteen and sixteen years, the offender is guilty of a misdemeanour only; above the age of sixteen years, the consent of the girl does away with any imputation of a legal offence. Girls who have passed the age of thirteen are considered to be capable of offering some resistance to the perpetration of the crime; and therefore, in a true charge, we should expect to find not only marks of violence about the pudendum, but also injuries of greater or less extent upon the body and limbs. It is probable that in these cases, if the charge were well founded, the hymen would be ruptured, as the intercourse is always presumed to be violent; but there might be some degree of penetration without this being a necessary result, especially if the membrane were small, or placed far up. At any rate, a girl at the age of thirteen may sustain all the injury, morally and physically, which the perpetration of the crime can possibly bring down upon her, whatever may have been the degree of penetration; and for this reason it is very properly laid down by our law that the crime consists in the mere proof of penetration. The fact, however, is generally clearly made out by the statement of the girl. Girls of tender age are sometimes violated by boys; the amount of physical injury inflicted in such cases is less than when the assailant is an adult. In addition to other cases reported, Geoghegan communicated to the author one which was the subject of a trial at the Liverpool Wint. Ass. of 1862. A boy aged seventeen committed rapes on two children, one aged eight years, and the other ten years; he then attempted to commit a rape on a third girl, aged eleven years. These crimes were perpetrated in about half an hour, during which time he was alone with the children. He was convicted of felony for rape on the youngest child, and sentenced to four years' penal servitude.

Rape on Young Females after Puberty.

With respect to *marks of violence* on the person, the exact form, position, and extent of these should be noticed, also their appearance, whether recent or of old standing. A false accusation of rape may be sometimes detected by the violence being in a situation in which it is not probable that the ravisher could have produced it. When bruises are found, the presence or absence of the usual zones of colour may occasionally throw light upon the time at which the alleged assault was committed. As these marks of violence on the person are not likely to have been produced with the concurrence of the girl, they are considered to furnish some proof of the intercourse having been against her will. But the physical appearances of rape about the genital organs may be found, whether the connection has been voluntary or involuntary. Thus rupture of the hymen, laceration of the vagina with effusion of coagula of blood, swelling and inflammation of the vulva, and stains of blood upon the person, dress, or furniture, may be met with in both cases. In making an examination, the greatest care should be taken by the practitioner to fix, at the time of examination, a probable date for the marks of injury to the genitals or other parts of the body, as it is by the aid of such observations that the truth or falsity of a charge may be sometimes clearly established.

Girls and unmarried young women are liable to *muco-purulent discharges* from the vagina, as a result of which the hymen may be destroyed. This kind of discharge arises from inflammation of the vagina (vaginitis), and it has been observed to follow an attack of scarlatina. When it exists, its real cause requires the closest scrutiny. At a more advanced age, young women are frequently subject to leucorrhœa. These cases are not likely to be mistaken for gonorrhœa; as here the female has it in her power to give some account of the circumstances, from which a medical opinion may be easily formed. It is possible, however, that a woman labouring under leucorrhœa may charge a man with the crime of rape, and affirm that this discharge had arisen from the act of the man. An inflamed and partially ulcerated (aphthous) state of the lining membrane of the vulva may apparently give support to the accusation. The discharge in leucorrhœa is of a mucous nature; that of gonorrhœa is of a purulent character; but purulent discharges may take place from the vagina as the result of intense inflammation, and quite irrespective of impure intercourse. ('Chelius's Surgery,' by South, vol. i. p. 160.) It would be impossible to distinguish such discharges from those of gonorrhœa; while a leucorrhœal discharge under great inflammatory action may resemble that of gonorrhœa. Such discharges commencing before, but continuing and sometimes becoming aggravated after marriage, have given rise to unfounded suspicions of infection from venereal disease imparted by the husband, and have thus led to suits of divorce. In a case reported by Legneau, a young married woman suffered from a discharge which was pronounced by a medical man, whom she consulted, to be gonorrhœal. This led to an application for a divorce. A further examination by other medical practitioners, with a complete history of the symptoms from which she had suffered, justified the conclusion that she was labouring under severe leucorrhœa when she was married, and that this was followed by granular vaginitis, which accounted for the muco-purulent discharge. ('Ann. d'Hyg.,' 1870, t. 2, p. 192.)

Defloration. Signs of Virginity.—It will be necessary to say a few words respecting the *signs of virginity.* Independently of cases of rape, this question may occasionally assume a practical bearing in relation to the signs of defloration. In civil cases a medical witness may be asked whether a woman has ever had intercourse or not; and proof of the fact may be necessary in order to confirm or rebut statements made by her in evidence. The question may be, not whether a woman has had a child, for this would resolve itself into a proof whether delivery had or had not taken place,—it may be limited to the probability or possibility of intercouse on her part at some antecedent period. A medical jurist, when consulted in such a case, can be guided only by the presence or absence of the external signs of virginity. The hymen may be intact, but this does not prove non-intercourse, because females have been known to become pregnant with the hymen uninjured; and an operation for a division of this membrane has been rendered necessary before delivery could take place. (Henke's 'Zeitschr. der S. A.,' 1843, vol. 2, p. 149.) Two instances of impregnation without rupture of the hymen are reported. ('New Orleans Med. Gaz.,' 1858, pp. 217, 220.) The hymen in each case required to be divided to allow of the delivery of the child. Other cases are reported. ('Amer. Jour. Med. Sci.,' 1859 p. 576.) Two have been published by Broun ('Vierteljahrsschr. für Gerichtl. Med.,' 1873, vol. 2, p. 197); and one well-marked case by St. Clair Gray. ('Glasgow Med. Jour.,' 1873.) A woman, æt 29, had been seven years married before this her first confinement. It was found that she had a persistent hymen of such size and form as completely to occlude the meatus except in its central part, where there was a small aperture. This had admitted of the menstrual flow and of impregnation. A crucial incision was made through it, and the woman was then delivered. In one case of pregnancy with unruptured hymen, the membrane was dense and concave, admitting the point of one finger, and by gradual pressure two fingers. This membrane was ruptured in delivery. ('Brit. Med. Jour.,' 1878, i. p. 863.) These facts generally admit of explanation by the membrane being of abnormal structure. Thus it has been found hard, dense, fibrous, resisting, and sometimes small in extent, thus only partially closing the vagina. Under opposite conditions, the persistence of this membrane might fairly lead to the inference that the female was chaste, and that there had been no intercourse. In the case of *Reppingull* v. *Reppingull*, in which the husband sued for a divorce, the evidence showed that the wife had not allowed her husband to have intercourse with her, and the marriage had never been consummated. At the same time, it was proved that she had privately visited the co-respondent; but she denied that there had been any intercourse. She was, subsequently to this, examined by Oldham, Gervis, and Barnes, and they deposed, from the state of the hymen, that she was still *virgo intacta.* On this the jury found that there had been no adultery.

The hymen may be destroyed by ulceration, as a result of inflammation of the genital organs. When the membrane has been thus destroyed by disease or other causes, or when it is congenitally absent, a medical opinion must be more or less conjectural; for one intercourse could hardly so affect the capacity of the vagina as to render the fact evident through life, and there is no other datum upon which an opinion could be based. The presence of the hymen is usually considered to be quite incompatible with the assumption that a woman has borne a child. A question of this kind incidentally arose in *Frazer* v. *Bagley* (Com. Pleas, Feb. 1844). It was alleged by the defendant that the plaintiff, a married man, had had adulterous intercourse with a young woman, and that at an antecedent period she had left her home for the purpose of giving birth to a child privately. Ashwell was called upon to examine the woman, and he deposed that, in his opinion, she was a virgin and had never borne a child. In spite of this evidence, the jury returned a verdict for the defendant. It is quite possible, however, that abortion may take place at the early periods of pregnancy, without the necessary destruction of the hymen. (See Henke, 'Zeitschrift,' 1844, vol. 1, p. 259.) Stolz, after remarking on the fact that women may conceive without the destruction of the hymen being necessarily involved, alleges that this membrane may still remain even after a woman has been delivered of a child. He quotes an instance within his own knowledge in which a young woman, whose hymen was in the form of a ring or loose diaphragm open in the centre, was delivered without any alteration being produced in it. It was only destroyed at her second delivery. ('Ann. d'Hyg.,' 1873, t. 2, p. 148.) The peculiar form of the hymen in this case might account for its persistence. Such cases must depend upon some exceptional conditions of the membrane.

This question is of importance, not only as it may affect the reputation of a woman, but the credibility and character of a person who makes an imputation of unchastity. In 1845, an assistant-surgeon was brought to a court-martial on the charge of having deliberately and falsely asserted that on several occasions he had had connection with a woman. This was denied by the woman, and evidence was adduced to show that she had still what is commonly regarded as the main sign of virginity, namely, an unruptured hymen. In consequence of this, the medical officer was found guilty, and cashiered. The woman was at the time about to be married, and this rendered the investigation all the more important to her. A surgeon, who examined the woman, deposed that he found the membrane of a semilunar form, and tensely drawn across the vagina; and his evidence was corroborated by that of a midwife. The inculpated person took up a double line of defence—first, that the examination of the woman was incomplete; and second, that the hymen, if present, would not justify the witnesses in saying that intercourse could not possibly have taken place. On the first point, it is unnecessary here to make a remark; but it appeared, from their own admissions, that the witnesses had never before examined women with this particular object. Assuming that there was no mistake, it becomes a question whether non-intercourse could in such a case be inferred from the presence of the membrane. Fruitful intercourse, it is admitted, may take place without rupture of the hymen: but such cases may be regarded as of an exceptional nature (p. 701, *ante*). The real question is whether, unless the hymen be in an abnormal state, intercourse can possibly occur between young and active persons without a rupture of this membrane. Intercourse is not likely to be confined, under these circumstances, to a mere penetration of the vulva. The membrane in this woman is stated to have been tensely drawn across the canal, and it was not tough; it was therefore in a condition to render it most easy for rupture. In the case of an old man, or of one of weak virile power, vulval intercourse might be had without destroying the membrane; but such a case could only be decided by the special circumstances which accompanied it. The presence of an unruptured hymen affords a presumptive, but not an absolute, proof that the woman is a virgin; and if of the ordinary size and shape, and in the ordinary situation, it shows clearly that, although attempts at intercourse may have been made, there can have been no vaginal penetration. Admitting the statements of the examiners to have been correct, it is improbable that this woman had had sexual intercourse several times, or even on one occasion.

In the case of *Delafosse* v. *Fortescue* (Exeter Lent Ass., 1853)—an action for defamation of character—the plaintiff, a married man, æt. 64, had been charged with committing adultery with a certain woman. Several witnesses for the defendant positively swore that they had seen these persons in carnal intercourse. This was denied by the plaintiff; and, as an answer to the case, medical evidence was tendered to the effect that the woman with whom the adulterous intercourse was alleged to have taken place had been examined and the hymen was found intact. This was admitted not to be a conclusive criterion of virginity. A verdict was returned for the defendant. The form and situation of the hymen in this case were not described; but it is to be presumed that these were not such as to constitute a physical bar to intercourse, or this would have been stated by the medical witness. Hence the persistence of the membrane was not considered to disprove the allegations of eye-witnesses. In *Howes* v. *Barber* (Common Pleas, June, 1865), the defendant alleged that he had seen the plaintiff, as he believed, in intercourse with an unmarried woman. This was denied by the plaintiff and the woman, and to support this denial medical evidence was called to show that there had been no intercourse. Oldham and Barnes examined the lady, and deposed that the hymen was entire, and that she was *virgo intacta*. In Scotland, this kind of medical evidence is not admissible. A wife sued the husband for divorce, on the ground, *inter alia*, that he had committed adultery with C. In defence, the defendant denied the adultery, and adduced C as a witness, who swore that such connection had never taken place. She also swore that she had submitted to an *inspectio corporis* by Simpson. The defendant then proposed to examine Simpson, that he might speak to the result of his examination. He argued that this was the best evidence that he could adduce in support of his innocence, as, if the girl were still a virgin, the adultery alleged could not have been committed. The court refused to admit the evidence, on the ground that it was merely in the form of an opinion; that other medical men might differ from him, even from the same observations; and that, as the court could not compel C to submit to another examination, the proposed evidence must be considered *ex parte* and inadmissible. (Sess. Cases, Edin., Feb. 1860.) In *Hunt* v. *Hunt*, a verdict was obtained against the alleged paramour in a case of adultery, and the damages were assessed at 50*l*. It was subsequently proved that the lady was *virgo intacta*. But so long as there are facts which show that women have actually conceived with the hymen still in its normal state, it is inconsistent to apply the terms 'virgo intacta' to women merely because this membrane is entire. A woman may assuredly have an unruptured hymen, and yet not be a *virgo intacta*. This can be decided only by the special circumstances proved in each case. Such *virgines intactæ* have frequently required the assistance of accoucheurs, and in due time have been delivered of children (p. 701, *ante*).

A question of this kind arose in *Reg.* v. *Harmer* (C. C. C., June, 1872). The prisoner was indicted for perjury. He was a waiter at a tavern, and being called as a witness in a divorce suit, swore that he had seen the parties in adulterous intercourse on more than one occasion. The lady with whom the adultery was alleged to have been committed denied this on oath, and Lee and another medical expert gave evidence that they had examined this lady, and found her to be a *virgo intacta*, no doubt from the persistence of the hymen. The recorder, in summing up, told the jury that this evidence was of the highest importance, and it was for them to consider whether it was sufficient to satisfy them of the guilt of the prisoner. He was found guilty.

In reference to these cases of persistent hymen, it is a question whether medical men, in forming an opinion, have sufficiently considered the variable structure of this membrane. It has been found to consist in some instances of tough fibrous or fibro-elastic tissue, and in such cases it might remain unruptured in married life as well as in cases of actual rape. St. Clair Gray has properly directed the attention of the profession to this subject. What may be true of a thin semilunar membrane placed in its normal position, will not be applicable to those instances in which its structure is abnormally firm, hard, and resisting. He published several cases ('Glasgow Med. Jour.,' May, 1873) which show that the hymen may be persistent for years in married women, in spite of attempts at intercourse. In one case, a woman, æt. 43, who had been married twenty-four years, the hymen was found by him entire—closing the meatus, with the exception of a small aperture which allowed of the menstrual flow. In a second case, a woman, æt. 30, had been married ten years and was childless. On examination, the hymen was found entire, and its persistence was evidently due to the presence in the tissue of fibrous or fibro-elastic bands, which rendered the structure as a whole very resilient. In this case, the hymen was forcibly ruptured by a speculum. In three cases of women who had been living in habits of prostitution for seven, eight, and eleven years respectively, the hymen was found unruptured. Its structure in these instances also accounted for its persistence. In all it was firm and elastic, and in one of them it had almost a cartilaginous hardness.

From cases already quoted, these facts, it will be seen, acquire some medico-legal importance. Intercourse may have taken place, although the hymen is found entire. In spite of its presence, a woman may have been guilty of a want of chastity. Even rape might be attempted, and legally perpetrated on adult women without necessarily rupturing this membrane. Married women have not always been conscious of this abnormal condition, but a woman desirous of separating from a husband might sue for a divorce on the ground that the marriage had never been consummated; and a medical man unacquainted with these facts might give an erroneous opinion from this persistent condition of the hymen. Tardieu has given excellent illustrations of the various forms of hymen. ('Attentats sur les Mœurs.')

CHAPTER 60.

RAPE ON MARRIED AND ADULT WOMEN.—CIRCUMSTANCES UNDER WHICH IT MAY BE PERPETRATED ON ADULT WOMEN.—LOSS OF PHYSICAL EVIDENCE.—PREGNANCY FOLLOWING RAPE.—MICROSCOPICAL EVIDENCE.—SODOMY.

On Married and Adult Women.—The remarks already made apply generally to married women, with this difference, that when a woman has already been in habits of sexual intercourse, there is commonly much less injury done to the genital organs. The hymen will in these cases be found destroyed, and the vulva dilated. Still, as the intercourse is presumed to be against the consent of the woman, it is most likely that when there has been a proper resistance some injury will be apparent on the pudendum; and there will be also, probably, extensive marks of violence on the body and limbs. Such cases are generally determined without medical evidence, by the deposition of the woman, corroborated, as it should always be, by circumstances. This statement regarding the presence of *marks of violence* on the pudendum of a married woman, on whom a rape is alleged to have been committed, requires some qualification. In two cases of rape on married women, in which the crime was completed in spite of the resistance of the women, there were no marks of violence on the genital organs in both cases. (*Reg.* v. *Owen and others,* Oxford Circ., 1839.) This may happen when the assailant is aided by accomplices.

On the other hand, the vagina alone may be the seat of violence, and no marks to indicate a struggle or the application of force be found on the body. In 1862, a woman was knocked down, her clothes were pulled over her face, and the crime of rape was perpetrated by the assailant. In the position in which she was held, with her arms and hands covered over, she was half suffocated, and unable to offer any effectual resistance. She was examined on the evening of the day of the assault. No marks of violence on her body were found, but the mucous membrane of the vagina at its commencement was contused, and lacerated in some portions, with blood oozing from them. It was considered that, under these circumstances, the statement of the woman was consistent with the fact that there were no marks of violence on her body. There was no reason to suppose that the injury to the vagina had been caused in any other way than by a criminal assault.

When a charge of rape is made by a prostitute, it is justly received with suspicion, and the case is narrowly scrutinized. Something more than medical evidence would be required to establish a charge under these circumstances. The question turns here, as in all cases of rape upon adult women, on the fact of *consent* having been previously given or not. This is the point at which the greater number of these cases of alleged rape break down; and it need hardly be observed, that this question has no relation to the duties of a medical witness: all that he can do is to establish, occasionally, whether or not sexual intercourse has been had with or without some violence. It is obvious that there may be marks of violence about the pudendum, or on the person, and yet the conduct of the woman may have been such as to imply consent on her part: we must not suppose that medical proof of intercourse is tantamount to legal proof of rape.

Possibility of perpetrating Rape on Adult Women.—Some medical jurists have argued that a rape cannot be perpetrated on an adult woman of good health and vigour; and they have treated all accusations made under these circumstances as false. Whether, on any criminal charge, a rape has been committed or not, is of course a question of fact for a jury, and not for a medical witness. The fact of the crime having been actually perpetrated can be determined only from the evidence of the prosecutrix and of other witnesses; still, a medical man may be able to point out to the court circumstances which might otherwise escape notice. Setting aside the cases of infants, idiots, lunatics, and weak and delicate or aged women, it does not appear probable that intercourse could be accomplished against the consent of a healthy adult, except under the following conditions:—

1. When narcotics or intoxicating liquids have been administered to her, either by the prisoner or through his collusion, provided that the intent be to stupefy or overpower, with the intention of having intercourse with the woman. The nature of the substance whereby insensibility is produced is, of course, unimportant. Thus the vapours of ether and chloroform have been criminally used in attempts at rape. In a case which occurred in France, a dentist was convicted of a rape upon a woman, to whom he had administered the vapour of ether. The prosecutrix was not perfectly unconscious, but she was rendered wholly unable to offer any resistance. ('Lond. Med. Gaz.,' vol. xl. p. 865.) A dentist was convicted of rape under somewhat similar circumstances in the United States; but it was thought that the woman had made the charge under some hallucination or delusion. In *Reg.* v. *Snarey* (Winchester Lent Ass., 1859), there was a clear attempt at fraud. The complainant asserted that she was *instantly* rendered insensible by the prisoner forcibly applying a handkerchief to her face, and she accused him of having committed a rape on her. The charge was disproved by a distinct *alibi*, as well as by the improbability of all the circumstances. Nevertheless, these cases must be viewed with extreme suspicion. It is sometimes difficult to convince a respectable woman, on recovery from the effects of an anæsthetic, that a criminal attempt has not been made upon her; and the efforts made to force a woman down during the administration of the anæsthetic, and whilst she is in a state of semi-consciousness, are apt to be misinterpreted. In one instance a young lady was accompanied to a dentist by her affianced lover, who never left her whilst an anæsthetic was administered and a tooth extracted. Yet this lady could scarcely be convinced subsequently that the dentist had not attempted to ravish her. In *Reg.* v. *Collier and Jones* (Durham April Ass., 1885), the prisoners, two young men, dosed a girl, æt. 17, with brandy till she was in a semi-intoxicated state, dragged her into a field, and in turn each had connection with her, the other man holding the woman to prevent resistance. Ten hours after, when examined by Arthur, there was no bruising visible, and no injury beyond such as would result from a first connection with consent. Penetration had been complete, and the vaginal mucus contained spermatozoa. The only external injury was a slight abrasion of the back of each elbow.

When the state of unconsciousness arises from natural infirmity, as in idiocy or imbecility, carnal intercourse with a woman is regarded as rape. (48 & 49 Vict., c. 69.)

In *Reg.* v. *White* (Northampton Wint. Ass., 1856), the judge, in charging the jury, stated that some doubts were entertained whether the crime of rape could be committed (in law) on the person of a woman who had rendered herself perfectly insensible by drink, so as to be unable to make any resistance: he thought it could not be alleged as an excuse for the man. The question was not reserved, as the prisoner was acquitted of rape, and found guilty of an indecent assault.

It may be a question whether a man can have intercourse with a woman without her knowledge while thus in a state of *unconsciousness from natural sleep.* Casper met with a solitary case in which a girl, æt. 16, accused a man of having had intercourse with her while she was sleeping in her bed, of which she was not conscious until he was in the act of withdrawing from her. According to her own statement, she was *virgo intacta* up to the date of this occurrence. Upon the facts of the case, Casper came to the conclusion that, if her statement was true, the man could not have had intercourse with her without causing pain and rousing her to a consciousness of her position. The hymen was not destroyed, but presented lacerations in two places. This and other facts showed that there had been intercourse, but did not prove that this had taken place without the consciousness of the woman. ('Klin. Novellen,' 1863, p. 31.) A man was charged with rape, and the prosecutrix swore that he had effected his purpose during her sleep. The bare possibility of the offence being perpetrated under these circumstances cannot be denied; but this admission could only apply to a case in which the woman had been accustomed to sexual intercourse, and in which the sleep was preternatural or lethargic. In this instance the woman was a prostitute, and the charge improbable. The respectable wife of an innkeeper, who had had children, threw herself on her bed with her clothes on, late one evening, and fell fast asleep. She was first awakened by finding a man upon her body, in the act of withdrawing from her. This man, *McEwan*, a servant in the house, was given into custody on a charge of rape. In the first instance, he did not deny the act, and there was no reason to believe that the prosecutrix was aware of the prisoner's conduct until the crime was completed, and she was awakened in the manner described, apparently by the weight of the prisoner's body. The prisoner was convicted. ('Edin. Month. Jour.,' 1862, ii. p. 570.) A case which may serve to throw light upon this question occurred to Casper. ('Gerichtl. Med.,' vol. 2, p. 574.) A married woman alleged that a man had had intercourse with her while in bed, and when she was asleep. In her deposition, however, she admitted she was conscious that some one was lying upon her, and that she asked who it was—showing, as Casper remarks, that she had a knowledge of what was going on, and some *doubt* whether the person was her husband.

In reference to this question whether it is possible to commit a rape upon a woman while asleep, a majority of the Scotch judges decided, in the case of *Sweenie* (Irvine's 'Just. Rep.,' vol. 3, p. 109), that the feloniously having connection with a woman while asleep was not indictable under the name of rape, inasmuch as, apart from the force implied in the act of connection, there was no force used to overcome the will of the woman. But they held, however improbable it might be, it was quite possible that a man might have connection with a woman while asleep. ('Edin. Month. Jour.,' 1862, ii. p. 570.)

The condition of the so-called *magnetic* or unnatural sleep has given rise to a question connected with the alleged perpetration of rape. A girl, æt. 18, consulted a therapeutic magnetizer as to her health. She visited him daily for some days. Four months and a half afterwards she discovered that she was pregnant, and made a complaint to the authorities against the magnetizer. They directed a physician and surgeon to determine the date of her pregnancy, and whether the complainant might have then been violated and rendered pregnant contrary to her will; *i.e.* whether her volition could have been completely or partially annihilated by magnetism. The medical inspectors were satisfied that the pregnancy did not extend further back than four months and a half; and founding their opinion on Husson's report, made to the Academy in 1831, concluded that, as a person in magnetic sleep is insensible to every kind of torture, sexual intercourse might then take place with a young woman without the participation of her will—without consciousness of the act, and consequently without the power to resist the act consummated on her. This opinion was confirmed by that of Devergie. ('Gaz. Méd. de Paris,' and 'Edin. Month. Jour.,' 1860, ii. p. 566.) There is another view of this case which does not seem to have occurred to the French medical experts, namely: 'Non omnes dormiunt quæ clausos habent oculos.'

A trial for rape took place at Rouen Assizes (Aug. 1878), in which a new theory was suggested by certain French physicians. A girl, æt. 20, consulted a dentist (Lévy), who placed her in his professional chair, and brought her to a horizontal position. He was charged with committing a rape. There was no doubt that intercourse had taken place, and the dentist admitted it,—but that it was with the consent of the girl. Her statement was that the accused passed something over her gums which gave a sensation of burning. In a few minutes she lost all consciousness, and when she awoke she felt pain in her sexual organs, and there were marks of blood on her thighs. No examination was made for two months. Four physicians who gave evidence as experts agreed that no anæsthetic had been used, but that the girl, being of an excitable temperament, had fallen at the time into an hysterical sleep, in which she would not be conscious of the act. One of them thought it might have been owing to hypnotism induced by the dentist. It seems that during this time the mother was in the room with her, and, although the girl uttered a cry, she did not interfere, not suspecting anything wrong. The dentist was convicted. This theory of *hysterical sleep* coming on suddenly, and being so profound as to destroy all consciousness of a first intercourse, is not supported by any experience. It is far more probable that the woman retained a sufficient amount of consciousness to resist the assailant, or that, if partially stupefied from any cause, she would have been roused by the act.

2. A rape may be committed on an adult woman if she falls into a state of syncope, or is rendered powerless by terror and exhaustion from long struggling with her assailant. Lord Justice Clerk Hope suggested to the author that, in his opinion, too great distrust is commonly shown in reference to the amount of resistance offered by women of undoubted character. Inability to resist from terror, or from an overpowering feeling of helplessness, as well as horror at her situation, may lead a woman to succumb to the force of a ravisher, without offering that degree of resistance which is generally expected from a woman so situated. As a result of long experience, he thought that injustice was often done to respectable women by acting on the opinion that resistance was not continued long enough.

3. When several are combined against the woman, in which case we may expect to find some marks of violence on her person, if not on the genital organs.

4. A woman may yield to a ravisher, under threats of death or duress: in this case her consent does not excuse the crime, but this is rather a legal than a medical question. An aged woman can scarcely be expected to resist a strong man. Chevers mentions a case in which a man was convicted of rape and aggravated assault on a woman of *seventy* years of age.

Rape may be perpetrated on a female at any age. Rapes on female infants and children are, as has been already stated, frequent. Boys have been on several occasions convicted of rape on young females. At the Lewes Sum. Ass., 1874, a boy of 14 was convicted of a rape on a girl under 12. The boy confessed the circumstances with great frankness and apparent unconsciousness of the nature and gravity of the offence.

Loss of Physical Evidence.—It is necessary to observe, in relation to the examination of married women, that the indications of rape on the genitals, however well marked they may have been in the first instance, either soon disappear or become obscure, especially in those who have been already habituated to sexual intercourse. After two, three, or four days, unless there has been an unusual degree of violence, no traces of the crime may be found about the genital organs. In the case of an adult married woman examined by Mayne, the appearance of injury which he discovered in and about the vagina had begun to heal in less than forty-eight hours; but in a case examined by Casper on the *ninth day*, the lining membrane of the vagina was still reddened, and the parts were still painful. In married women, or in those accustomed to sexual intercourse, no inference can be drawn from a dilated state of the vagina. In unmarried women, and in children when there has been much violence, these marks may persist and be apparent for a week or longer. If there has been great laceration of the sexual organs, then certain appearances in the form of cicatrices may remain; but in all cases great caution should be observed in giving an opinion of rape having been perpetrated, from an examination made two or three weeks after the alleged commission of the offence. Marks of violence on the person can never establish a rape; they merely indicate, *cæteris paribus*, that the crime may have been attempted.

Pregnancy following Rape.—It has been a question whether, when intercourse has taken place against the will of a woman, *i.e.* in the perpetration of rape by violence, pregnancy could possibly follow. It was at one time thought that the will of a woman was always necessary to the act of impregnation, and therefore if she became pregnant, she must have consented to the act, and that the charge of rape was unfounded. Such a defence would neither be admitted as an answer to a charge of rape, nor show, under any circumstances, that intercourse had been had with consent. Conception does not depend on the consciousness or volition of a woman. If the state of the uterine organs be at the time in a condition favourable to impregnation, this may take place as readily as if the intercourse had been voluntary; even penetration to the vagina is not absolutely necessary for impregnation. ('Lond. Med. Gaz.,' vol. xliv. p. 48.) A woman became pregnant after a rape committed on her by a man who subsequently married her: the date of intercourse was thereby accurately fixed, and a child was born after 263 days' gestation. (See also Stolz, 'Ann. d'Hyg.,' 1873, t. 2, p. 146.)

It has been supposed that, in cases of pregnancy following rape, in spite of resistance at first, a woman may in the end have voluntarily joined in the act. We know of no ground for adopting this theory: the general opinion is that conception may occur, and is neither accelerated nor prevented by the volition of the sexes. Many women in married life who anxiously wish for children have none, and *vice versâ;* and physical impediments do not suffice in all cases to explain these facts. Women are reported to have conceived during the states of asphyxia, intoxication, or narcotism. Ryan mentions a case in which a young woman became unconsciously pregnant from intercourse had with her by a man while she was in a state of intoxication, and in which it was clearly impossible that her volition could have taken any share. ('Med. Jurispr.,' p. 245.) In married life women frequently become pregnant against their will, and in a great number of cases without any consciousness of their condition until pregnancy is far advanced. Those who affirm that without the active will of the woman there can be no conception, must deny the existence of cases of impregnation in a state of unconsciousness (p. 517, *ante*); but the facts are too strong and too numerous to be met with a simple denial. A medical jurist, therefore, who relied upon pregnancy following alleged rape, as a proof of *consent* on the part of the woman, and who would infer from this result that the intercourse must have been voluntary on her part, would inflict great injustice by such an opinion. The extrusion of an ovum does not depend on the will of a woman, but is a periodical condition; the action of the spermatozoa on this ovum is as much removed from the will of the woman as it is from that of the man.

This subject would have hardly required so much notice, but for the fact that in some trials it has been put forward with a view to discredit the evidence of a woman, where pregnancy has followed intercourse in a state of alleged unconsciousness. Any statement of this kind certainly requires a close examination, because, generally, there is a strong motive for falsehood on the part of the woman. In the case of *Bromwich* v. *Waters* (pp. 639, 644, *ante*), the woman Whalley had had a child, but stated that she had not been conscious of any intercourse. The fact that she had borne a child did not prove that her statement was false, although a suggestion to this effect was made. We may fairly doubt whether a woman could have intercourse unconsciously, but because impregnation follows, this is no proof that she is guilty of falsehood or perjury.

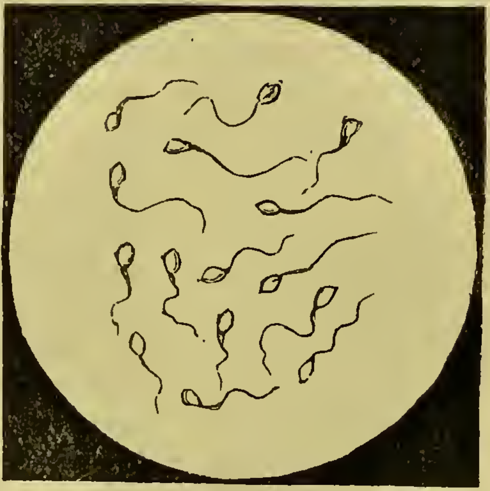
Microscopical Evidence.—As part of the medical evidence in cases of rape, it may be necessary to examine *spots* or *stains* on the linen of the prosecutrix and the accused. Cases of rape are, however, commonly tried in this country without reference to this species of evidence; and it is not easy to perceive how this can be necessary to the proof of the crime in the living, when the present law of England demands only proof of penetration, and not of *emission.* Thus, a rape may be legally completed without reference to emission; and, medically speaking, it appears quite possible that there might be marks of emission without any penetration, as in a protracted resistance on the part of a woman. Admitting that certain stains of this description are found on the clothes of an accused person, are these to be taken as furnishing undeniable proof of the legal completion of rape by penetration? It appears that, without corroborative evidence from the state of the female organs, they cannot be so taken; and therefore the affirmative evidence from the microscope, under these circumstances, is as liable to lead to error as that which is purely negative. The fact that spermatic stains are found on the linen of the prosecutrix may, however, become occasionally of great importance in charges of assault with intent.

Examination of Stains.—There are no *chemical* tests on which we can safely rely for the detection of spermatic stains. The appearance produced by a dried spermatic stain on linen or cotton is like that produced by a diluted solution of albumen. The fibre of the stuff is stiffened, and the stain, particularly at the margin, has a slightly translucent appearance, as if the stuff had been wetted by diluted gum or albumen, but without any shining lustre. In the dry state, the stains present no well-marked colour or odour. Slips of the stained linen, when soaked in water, yield a slightly alkaline, opaque, muco-albuminous liquid. This liquid, unlike a solution of albumen, is rendered rather strongly yellow by diluted nitric acid. By the action of warm water, the stained linen, even although it may have been kept dry for a considerable period, has been observed to evolve the peculiar faint odour of the spermatic secretion.

The stained linen, or a part of it, should be cut into small pieces, taking care that it is not roughly handled. These should be placed in a watch-glass, with a sufficiency of a 3 per cent. solution of common salt to soak it thoroughly, and to allow the fibre of the stuff to become quite penetrated by the water. It is advisable not to move the stuff or agitate the liquid, but to allow it to be quietly imbibed. The watch-glass should be covered so as to prevent evaporation. After half an hour, the fibres may be turned and allowed to macerate for some time longer. The stained linen may then be removed, and the soaked fibres of the stuff gently pressed on several glass sides. The liquid thus obtained by pressing the stained linen is slightly opaline. It is found that this opalescence is removed by the addition of a small quantity of ammonia or diluted acetic acid; these liquids do not affect the forms of the spermatozoa. Care must be taken not to use more liquid than is actually required to moisten the stained stuff and to allow a small portion to be pressed out of it.

The liquid on the slide may be then covered with thin glass, and examined under the microscope. The dead spermatozoa may then be seen as in the annexed engraving (Fig. 55). They have flattened ovoid heads, with long tapering tails which are from nine to twelve times the length of the head. They are usually associated with granular bodies and epithelial scales. Fibres of cotton, linen, or woollen may be mixed with them, and there may be also pus, mucus, or blood-globules. Their form is so peculiar that, when once well seen and examined, they cannot be confounded with any other substance, vegetable or animal, nor with ordinary care can any vegetable fibres be mistaken for them, although these may be mistaken for their tails or filaments. Particular notice should be taken of any hairs or fibres found in such stains. They may be human or animal hairs, and the fibres may, by their nature, form, and colour, be connected with some article of dress worn by the woman or the person accused of rape. Spermatozoa appear to retain life long after the death of the body. Hofmann states that he has observed the active movements of these bodies from eighty to a hundred hours after death.

Fig. 55.



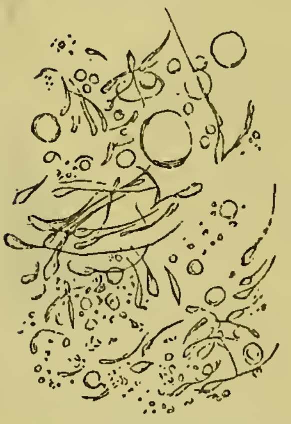
Spermatozoa, magnified 450 diameters.

Some observers have advised that the expressed liquid obtained from spermatic stains should be allowed to dry spontaneously on the slide and then examined in the dry state. When humid, the bodies and especially the tails are so transparent that the whole spermatozoon may escape observation. One part only may come into focus at a time. They become opaque by drying, and may be seen in darker lines, sometimes in their whole length. Roussin recommends the addition of a solution of iodine in iodide of potassium to the liquid submitted to examination. He has found that it brings out the entire form of the spermatozoon of a deep yellow colour, and thus makes a distinction between it and other fibrous substances. ('Ann. d'Hyg.,' 1867, t. 1, p. 154.) Aniline colours may also be used to develop spermatozoa.

As it has been elsewhere stated, the spermatozoa, although peculiar to the seminal fluid, are not found in the very young, the very old, or in those who are labouring under long-standing disease of the testicles (p. 670). Even in the cases of healthy married men who have had children, spermatozoa are not always found in the spermatic secretion; their presence, size, and number are subject to great uncertainty. Exhaustion from frequent intercourse, or constitutional causes without actual bodily disease, appear to influence their production. There are also various other conditions in which they are not found; these have been fully examined by Casper. ('Gerichtl. Med.,' vol. 2, p. 141.) Hence the discovery of spermatozoa in stains on articles of clothing demonstrates that they have been produced by the spermatic liquid; but their non-discovery, under these circumstances, does not prove that the stains have not been caused by this liquid.

The detection of dead or motionless spermatozoa in stains may be made at long periods after emission, when the fluid has been allowed to dry (Fig. 56). In three cases, at intervals of from one week to seven weeks after the perpetration of the crime, Casper was enabled to demonstrate the presence of spermatozoa on articles of clothing, and thus to furnish strong corroborative evidence. Koblanek made experiments on this subject, in reference to different periods of time; he found these bodies distinctly after twelve months. The discovery of one distinct and entire body is quite sufficient to justify a medical opinion of the spermatic nature of the stain. Bayard states that he has been able to detect spermatozoa in stains after six years ('Man. Prat. de Méd. Lég.,' p. 277); and Roussin, after the long period of eighteen years. ('Ann. d'Hyg.,' 1867, t. 1, p. 152.) The editor has found them in a stain after the lapse of three years.

Fig. 56.



Spermatozoa in stains after two years (Gosse) magnified 500 diameters.

A medical witness must be prepared to consider the precise value of evidence furnished by the microscope in the examination of stains on the dress of a man accused of rape. A shirt may present stains of blood, urine, mucus, or gonorrhœal discharge, some of which, but for the microscope, might be mistaken for spermatic stains. Admitting that, by the process above described, the microscope enables an examiner to affirm that the stains have really been caused by the spermatic secretion, this does not prove that a rape has been committed, or even that intercourse has been necessarily had with a woman. Such stains may arise from spontaneous natural discharge, or from disease (spermatorrhœa), and therefore in themselves they afford no proof of intercourse. If, from other circumstances in the case, it should be clearly and satisfactorily proved that there has been intercourse, then the presence of blood mixed with the spermatic stains might, in certain cases, justify an opinion that violence had been used. The discovery of spermatic stains on the dress of a woman furnishes stronger evidence of intercourse, attempted or perpetrated, than their discovery on the dress of a man; but admitting that intercourse is thus proved, it may still have taken place with the consent of the woman. These stains, when found on the clothing of girls and infants, afford a strong corroborative proof of the perpetration of the crime.

Microscopical Evidence from the Woman.—It may become necessary to determine, in reference to a woman, whether intercourse has or has not recently taken place. All observers agree that, within a certain period after connection, the fact may be established by an examination of the vaginal mucus. A small quantity of this mucus placed upon glass, and diluted with water, will be found to contain spermatozoa, if the suspicion be correct. In addition to other characters, it may be remarked that the living spermatozoa move for many hours out of the body when kept at a temperature of 98° F., and they even retain their rapid motions when the spermatic liquid is mixed with water; but these motions sometimes cease immediately on the addition of urine or chemical reagents. According to Müller, the spermatozoa may retain vitality (or free motion) in the body of a woman for the period of seven or eight days, and even longer. Bayard states that he has thus detected them in the vaginal mucus of females not subject to morbid discharges, at various intervals up to three days after intercourse (op. cit., p. 277); and Donné found them under similar circumstances in a woman who had been admitted into the hospital the day before (op. cit., p. 305). This evidence may become of value in a charge of rape, but it may be easily destroyed by the presence of leucorrhœa; and it is open to an objection, that in certain morbid states of the vaginal mucus of the human female, there is found in it a microscopic animalcule, called by Donné the *Trichomonas vaginæ;* but this has a much larger body and a shorter tail than the spermatozoon. Other substances may be sometimes found in the vaginal mucus. (See case by Lender in 'Vierteljahrsschr. für Gerichtl. Med.,' 1865, p. 355.)

Marks of Blood on Clothing.—Marks of blood upon the linen can, of course, furnish no evidence unless taken with other circumstances. The linen may be intentionally spotted or stained with blood for the purpose of giving apparent support to a false accusation. Bayard met with a case of this kind, in which a woman charged a youth with having committed a rape upon her infant child. On examination, the sexual organs were found uninjured; and on inspecting the marks of blood on the clothes of the child, it was observed that the stains had been produced on the *outside* of the stuff, and bore the appearance of smearing; the whole fibre had not even been completely penetrated by the liquid. The falsehood of the charge was thus established. ('Ann. d'Hyg.,' 1847, t. 2, p. 219.) A case involving a false charge of rape was tried at the Glasgow Aut. Circuit, 1859. One of the witnesses, an accomplice, proved that she had purchased some blood and handed it to the woman who made the charge, and she saw her smear it over her person and on some sheets on which it was alleged the rape was perpetrated. The woman (*Boyle*) and her husband, who made this false charge, were convicted of conspiracy.

It may be a question whether marks of blood on the linen of a prosecutrix were caused by effusion as a result of *violence* or by the *menstrual fluid.* In its normal state, this fluid, in respect to the presence of red corpuscles and of serum, resembles blood. That fibrin is frequently present is obvious from its being occasionally discharged in a clotted state ; hence the discovery of fibrin in a stain would by no means necessarily imply that the blood was not derived from the menstrual fluid. The French Academy of Medicine appointed as a committee Adelon, Moreau, and Le Canu, to examine this question in the most comprehensive manner. These gentlemen reported that, in the then state of science, there was no certain method by which menstrual blood could be distinguished from that effused from the blood-vessels in a case of child-murder or abortion, and this statement still holds good. (' Ann. d'Hyg.,' 1846, t. 1, p. 181 ; see *ante,* pp. 283, 557.) Even the presence of epithelial scales and mucus would not prove the stain to be menstrual, unless it could be shown that the mucus was actually effused with the blood which caused the stain. The epithelial scales naturally found in vaginal mucus are flat nucleated cells, oval, round, or polygonal in shape, and vary in size. They are spread over the mucous membrane, not only of the vagina, but of the mouth, pharynx, gullet, conjunctiva, and the serous and synovial membranes. There must be great caution in relying upon this microscopical evidence.

Evidence of Violation in the Dead.—The body of a child or woman is found dead, and a medical witness may be required to determine whether her person has or has not been violated before death. There is here some difficulty, because there will be no statement from the prosecutrix herself. The witness can seldom do more than express a conjectural opinion, from the discovery of marks of violence on the person and about the genital organs. Even if spermatozoa were detected in the liquid mucus of the vagina, or on the dress of a woman, this would merely prove that there had been intercourse. In a case of alleged murder tried at Edinburgh, the first point to be determined in examining the dead body was whether a rape had or had not been committed. The examination of the stains on the dress was conclusive, when taken in conjunction with the other evidence. The jury convicted the man of a rape, but acquitted him of the murder. (For another case in which evidence was obtained on the examination of a dead body, see Casper's 'Klin. Novellen,' p. 17.)

Rape by Females on Males.—So far as we can ascertain, this crime is unknown to the English law. Several cases of this kind have, however, come before the French criminal courts. In 1845, a female, aged eighteen, was charged with having been guilty of an act of indecency, with violence, on the person of Xavier T., a boy under the age of fifteen years. She was found guilty. In another case, a girl, aged eighteen, was charged with rape on two children—the one eleven, and the other thirteen years of age. It appeared in evidence that the accused enticed the two boys into a field, and there had forcible connection with them. This female was proved to have had a preternatural contraction of the vagina, which prevented intercourse with adult males. She was found to be labouring under syphilitic disease, and the proof of her offence was completed by the disease having been communicated to the two boys. She was condemned. ('Ann. d'Hyg.,' 1847, t. 1, p. 463.) Casper describes cases of this description which have fallen under his observation. ('Gerichtl. Med.,' vol. 2, p. 129; and 'Klin. Novellen,' 1863, p. 15.) By the Penal Code of France, it is a crime in either sex to attempt intercourse with the other, whether with or without violence, when the child is under eleven years of age. That this offence is perpetrated in England, under the mistaken notion that gonorrhœa and syphilis are thereby cured, cannot be doubted. It is by no means unusual to find, in the wards of hospitals, mere boys affected with venereal disease. In some instances this may be due to precocious puberty; but, in others, it can only be ascribed to that unnatural connection of adult females with male children, which is punished as a crime in the other sex. The only accessible medical proof would consist in the transmission of gonorrhœa or syphilis from the woman to the child.

Unnatural Offences.

Pederastia. Sodomy. Buggamy.—This crime is defined to be the unnatural connection of a man with mankind, or with an animal. The evidence required to establish this crime is the same as in rape, and therefore penetration alone is sufficient to constitute it. There are, however, two exceptions: first, it is not necessary to prove the offence to have been committed against the consent of the person upon whom it was perpetrated; and second, both agent and patient (if consenting) are equally guilty; but the guilty associate is a competent witness. In one case (*Rex* v. *Wiseman*), a man was indicted for having committed this offence with a woman, and a majority of the judges held that this was within the statute. Unless the person is in a state of insensibility, it is not possible to conceive that this offence should be perpetrated on an adult of either sex against his or her will: the slightest resistance would suffice to prevent its perpetration. In 1849, a question on this point was referred to the author from Jamaica. A man was convicted of the crime of sodomy, alleged to have been committed on the complaining party while he was asleep. The only evidence against him was the statement of the complainant. The opinion given was in conformity with that of Ferguson, namely, that the perpetration of the act during a state of natural sleep was contrary to all probability. The remarks already made in reference to rape during sleep may be applied with greater force to acts of this nature (p. 708, *ante*). If this crime is committed on a boy under fourteen years, it is felony in the agent only; and the same, it appears, as to a girl under twelve. ('Archbold,' p. 409.) The act must be in the part where it is usually committed in the victim or associate of the crime.

Sodomy is commonly understood to signify unnatural intercourse between man and man, while bestiality (buggarny) implies unnatural intercourse with animals. Continental medical jurists have invented a new term, *Pederastia* (παιδὸς ἐραστῆς, *pueri amator*), comprising those cases, not unfrequent, in which boys at about the age of puberty are made the victims of the depraved passions of men; but this term is not applicable to the crime committed by and between adults. The medical aspects of this subject have been fully examined by Tardieu, 'Ann. d'Hyg.,' 1857, t. 2, pp. 133, 397, and 1858, t. 1, pp. 137, 152; also by Toulmouche, 'Ann. d'Hyg.,' 1868, t. 2, p. 121; and by Penard, 'Ann. d'Hyg.,' 1860, t. 2, p. 367. The symptoms indicative of this unnatural intercourse both in agent and patient are fully described by these writers. Casper has also dealt with this crime, and the medical evidence required to prove it. ('Gerichtl. Med.,' vol. 2, p. 176.)

The facts are commonly sufficiently proved without medical evidence; except in the cases of young persons, when marks of physical violence will in general be sufficiently apparent. In some instances, proof of the perpetration of the crime may be obtained by resorting to microscopical evidence. Stains upon the linen of young persons may thus furnish evidence that the crime has been attempted, if not actually perpetrated.

Unless an examination is made soon after the perpetration of the crime, the signs of it will disappear. In the case of one long habituated to these unnatural practices, certain changes have been pointed out as medical proofs,—among them a funnel-shaped state of parts between the nates, with the appearance of dilatation, stretching, or even a patulous state of the anus and a destruction of the folded or puckered state of the skin in this part. There may be also marks of laceration, cicatrices, &c., and sometimes evidence may be derived from the presence of syphilitic disease. This condition of parts would represent the chronic state induced by these practices in the patient or succubus. In the recent or acute form, fissure and laceration of the sphincter ani, with bruising and effusion of blood, will be found.

Trials for sodomy and bestiality are very frequent, and convictions of men and boys have taken place for unnatural intercourse with cows, mares, and other female animals. Medical evidence is seldom required to sustain the prosecution. There may be, however, circumstances which can only be properly interpreted by a scientific expert. The hair of the animal may be found on the perpetrator, or marks of blood or feculent matter upon his dress, and in such cases chemical analysis or the microscope may enable a witness to express an opinion in proof or disproof of the charge. In one case, where a man was charged with having had unnatural intercourse with a cow, the prosecution was able to show that some short coloured hairs found on the prisoner's person resembled those of the animal. False charges of sodomy are frequent, and are made for the purpose of extortion.

A question may arise here respecting the examination of an accused person, which has already been considered in reference to women charged with infanticide. The examination should be with the consent of the accused, and not made against his will, since no one is bound to furnish evidence against himself (see *ante*, p. 625). (In reference to the evidence derivable from the hair of animals, see 'Vierteljahrsschr. für Gerichtl. Med.,' 1865, 1, 160.)

INSANITY.

CHAPTER 61.

WHAT IS INSANITY?—MEDICAL DEFINITIONS.—DISTINCTION OF SANE FROM INSANE PERSONS.—MORAL INSANITY.—LEGAL DEFINITIONS.—'NON COMPOS MENTIS.'—SYMPTOMS OF INCIPIENT INSANITY.—HALLUCINATIONS AND ILLUSIONS.—LUCID INTERVALS.

What is Insanity? Medical Definitions.—The terms 'insanity,' 'lunacy,' 'unsoundness of mind,' 'mental derangement,' 'madness,' and 'mental alienation or aberration,' have been indifferently applied to those states of disordered mind in which a person loses the power of regulating his actions and conduct according to the ordinary rules of society. In all cases of real insanity, the intellect is more or less affected—hence the term *intellectual insanity*. In a medical sense this implies a deviation of the mental faculties from an assumed normal or healthy standard. In an insane person, his language and habits are changed—the reasoning power which he may have enjoyed in common with others is lost or perverted, and he is no longer fitted to discharge those duties which his social position demands. Further, from perversion of reason, he may show a disposition to commit acts which may endanger his own life or the lives of those around him. It is at this period that the law interferes for his own protection, and for that of society.

Many attempts have been made by psychologists to define insanity; but the definitions hitherto given are so imperfect that it would be difficult to find one which includes all who are insane, and excludes all who are sane. This difficulty is fully accounted for by the fact that mental disorder varies in its degree as well as in its characters; and the shades of disordered intellect in the early stages are so blended as to be scarcely distinguishable from a state of insanity. It is this twilight condition of the mind, when it is fluctuating between sanity and insanity, which no definition can comprise, especially as the mind differs in its power and manifestations in most persons, and it is therefore difficult to fix upon a standard by which a fair comparison can be made. The vulgar notion of insanity is that it consists in an entire deprivation of reason and consciousness; but the slightest acquaintance with the insane proves that they are not only perfectly conscious of their actions in general, but that they reason upon their feelings and impressions. Abercrombie considered insanity to consist in a loss of the faculty of *attention*—that power by which we are capable of changing, controlling, arresting, or fixing the current of our thoughts. Conolly regarded it as a disorder of the power of *comparison or judg-*

ment, and Marc as a loss of the faculty of *volition;* so that, in the latter point of view, the acts of the insane are in a certain sense involuntary, and depend upon impulses which, owing to mental disease, they are unable to control.

These definitions are defective, inasmuch as they are not adapted to the various forms of the disease. Etymologically, the term implies the negation of something, and not a positive state (Orange). In some cases of insanity, as in confirmed idiocy, there is no evidence of any exercise of the intellectual faculties; but in most instances these faculties, and the moral feelings, are partially diseased or partially destroyed, in every variety and degree. Thus we may meet with cases in which the faculties of attention, comparison, and volition are more or less impaired or absent, or, if present, they are never perfect, although each may not be equally affected. When no two cases are precisely similar, no definition can include all varieties of the disorder. A medical witness who ventures upon a definition, will therefore generally find himself involved in numerous inconsistencies, for no words can possibly comprise the variable characters which this malady is liable to assume. Savage is of opinion that no standard of insanity, as fixed by nature, can under any circumstances be considered definitely to exist. ('Insanity,' p. 1.) Bucknell defines insanity as a disease of the brain affecting the integrity of the mind, whether marked by intellectual or emotional disorder; whilst Maudsley considers it to be a disorder of the supreme nerve-centres of the brain—the special organs of mind. It will be observed that these definitions include something more than mere intellectual insanity. Those who take an interest in definitions of insanity, and who think they can defend them from the critical acumen of lawyers, will find them fully set forth in their medical and medico-legal aspects in a paper by Rorie. ('Edin. Month. Jour.,' 1865, ii. p. 13.) There are, however, cases in which a medical man may find himself compelled, if not to define insanity, at least to draw some clear distinction between a sane and an insane person. Thus in cases in which there has been an alleged breach of the law regarding the custody of lunatics, it may be pleaded that the person is sane, and a medical expert must then be prepared to say whether the person concerning whom the question is raised is idiotic, lunatic, or of unsound mind, and to assign satisfactory reasons for his opinion.

Moral Insanity.—In addition to that form of insanity in which the mind is affected, known as *intellectual insanity*, Prichard and other medico-legal writers have described a state which they call *moral insanity* (*mania sine delirio*), which is manifested simply by a perverted or disordered state of the feelings, passions, and emotions, irrespective of any apparent intellectual aberration. There are no hallucinations or illusions, and there is no evidence of delusion, but simply a perversion of the moral sentiments. Thus it is alleged that this form of insanity may appear in the shape of a causeless suspicion, jealousy, or hatred of others, especially of those to whom the affected person ought to be attached; and it may also manifest itself under the form of a wild, reckless, and cruel disposition towards mankind in general. It does not seem probable, however, that moral insanity, as thus defined, ever exists or can exist in any person without greater or less disturbance of the intellectual faculties. The mental powers are rarely disordered without the moral feelings partaking of this disorder; and conversely, it is not to be expected that the moral feelings should become to any extent perverted without the intellect being affected, for perversion of moral feeling is generally observed to be one of the early symptoms of disordered reason. The intellectual disturbance may sometimes be difficult of detection; but in every case of true insanity it is more or less present, and it would be a highly dangerous practice to pronounce a person insane, when some evidence of its existence was not forthcoming. The law does not certainly recognize moral insanity as an independent state; hence, however perverted the affections, moral feelings, or sentiments may be, a medical jurist should always look for some indications of disturbed reason. Medically speaking, there are, according to Prichard, two forms of insanity, moral and intellectual; but in law, apparently, there is only one—that which affects the *mind.* Moral insanity is hardly admitted as a bar to responsibility for civil or criminal acts, except in so far as it may be accompanied by *intellectual* disturbance. Mayo denied its existence, and contended that no abnormal state of mind should confer irresponsibility unless it involves intellectual as well as moral perversion. ('Med. Testimony,' p. 69.) Brodie also considered that there are no reasonable grounds for admitting this to be an independent form of insanity. There has been, as he suggests, much mystification on the subject. The term has been applied to cases in which the name of insanity ought not to have been applied at all, *i.e.* to 'moral depravity,' and also to cases in which delusions have really existed, and which might therefore have been more properly classed with cases of ordinary mental aberration. ('Psych. Inquiries,' p. 99.) Others, however, stoutly contend for its legal recognition. Of one fact we may be well assured: if in these cases of alleged *moral* insanity there is no indication of a perversion of intellect, *medical* evidence is not required to determine the degree of responsibility in reference to such persons. Those who administer the law, and any man endowed with plain common sense, will be as well qualified as a medical expert to decide the question of criminal responsibility. Further, until medical men can produce a clear and well-defined distinction between moral depravity and moral insanity, such a doctrine, employed as it has been for the exculpation of persons charged with crime, should be rejected as inadmissible.

Legal Definitions.—The law of England recognizes two states of mental disorder or alienation: (1) *Dementia naturalis,* corresponding to idiocy; and (2) *Dementia adventitia,* or *accidentalis,* signifying general insanity as it occurs in persons who have once enjoyed reasoning power. To this state the term 'lunacy' is also applied, from an influence formerly supposed to be exercised on the mind by the moon, and still believed in by many attendants on the insane. *Lunacy* is a term generally applied to those disordered states of mind which are known to medical men under the names of mania, monomania, and dementia;

and which are frequently, although not necessarily, accompanied with lucid intervals. The main character of insanity, in a legal view, is considered to be the existence of *delusion; i.e.* that a person should believe something to exist which does not exist, and that he should act upon this belief. Many persons may labour under harmless delusions, and still be fitted for their social duties; but should these delusions be such as to lead them to injure themselves or others in person or property, then the case is considered to require legal interference.

In addition to the terms *Idiocy* and *Lunacy*, we find another frequently employed in legal proceedings, namely '*unsoundness of mind*' —(*non compos mentis*)—of the exact meaning of which it is impossible to give a consistent definition. According to Winslow, the phrase, 'unsoundness of mind,' was first used by Lord Eldon to designate a state of mind not exactly idiotic, and not lunatic with delusions, but a condition of intellect occupying a place between the two extremes, and unfitting the person for the government of himself and his affairs. ('Lancet,' 1872, i. p. 108.) This definition has been since generally accepted and acted on by all the judges. From various legal decisions, it would appear that the test for unsoundness of mind in law has no immediate reference to the existence of *delusion* in the mind of a person, so much as to proof of incapacity from some morbid condition of intellect to manage his affairs with ordinary care and propriety. (Amos.) Neither condition will suffice to establish unsoundness without the other; for the intellect may be in a morbid state, and yet there may be no legal incompetency; or the incompetency alone may exist and depend on bodily infirmity or want of education—conditions which must not be confounded with mental disorder. Thus, then, a person may be of unsound mind, *i.e.* legally incompetent to the control of his property, and yet not come up to the strict legal standard of lunacy or idiocy. The most recent writer of the legal profession, on the subject of insanity, thus defines the disease: 'Sanity exists when the brain and the nervous system are in such a condition that the mental functions of feeling and knowing, emotion and willing, can be performed in their regular and usual manner. Insanity means a state in which one or more of the above-named mental functions is performed in an abnormal manner, or not performed at all, by reason of some disease of the brain or nervous system.' (Stephen, J., 'Hist. of the Crim. Law of Eng.,' vol. iii. p. 130.)

Some medical practitioners have attempted to draw a distinction between *insanity* and *unsoundness* of mind. A case occurred in 1839, in which a medical man hesitated to sign a certificate for the confinement of an alleged lunatic, because in it the words 'unsound mind' were used. He said he would not have hesitated to sign it had the term 'insane' been employed. The difference, if any exist, is purely arbitrary, and depends on the fact that 'unsound mind' is a legal and not a medical phrase, referring to an incapacity to manage affairs, which insanity, in its most enlarged sense, does not always imply. The law, however, appears to admit some sort of distinction; for, according to Chitty, it is a criminal and an indictable act maliciously to publish that any person is afflicted with insanity, since it imputes to him a malady generally inducing mankind to shun his society; although it is not libellous to say that a man is not of sound mind, because no one is of perfectly sound mind but the Deity. 'Soundness' is here used as synonymous with 'perfection.' ('Med. Juris.,' vol. i. p. 351). In reference to the signing of certificates of insanity, it is, however, an error to suppose that the use of one term can involve a practitioner in any greater share of responsibility than the use of the other.

As regards this legal view of insanity, in its bearings upon crime, a distinguished judge, already quoted, has recently summed up a description of madness as known to the law in the following terms (Stephen's 'Hist. of the Crim. Law of England,' vol. ii. p. 145):—'Any one or more of numerous causes may produce diseases of the brain or nervous system, which interfere more or less with the feelings, the will, and the intellect of the persons affected. Commonly, the disease, if it runs its full course, affects the emotions first, and afterwards the intellect and the will. It may affect the emotions either by producing morbid depression or by producing morbid excitement of feeling. In the first, which is much the commoner of the two cases, it is called melancholia, and in the second mania. Melancholia often passes into mania. Both melancholia and mania commonly cause delusions or false opinions as to existing facts, which suggest themselves to the mind of the sufferer as explanations of his morbid feelings. These delusions are often accompanied by hallucinations, which are deceptions of the senses. Melancholia, mania, and the delusions arising from them often supply powerful motives to do destructive and mischievous acts; and cases occur in which an earnest and passionate desire to do such acts is the first, and perhaps the only marked, symptom of mental disease. It is probable that in such cases some morbid state of the brain produces a vague craving for relief by some sort of passionate action, the special form of which is determined by accidental circumstances; so that such impulses may differ in their nature and mode of operation from the motives which operate on sane and insane persons alike. The difference may be compared to the difference between hunger prompting a man to eat, and the impulse which, when he suffers violent and sudden pain, prompts him to relieve himself by screaming. Insanity affecting the emotions in the forms of melancholia and mania is often succeeded by insanity affecting the intellect and the will. In this stage of the disease, the characteristic symptom is the existence of permanent incurable delusions, commonly called monomania. The existence of any such delusion indicates disorganization of all the mental powers, including not only the power of thinking correctly, but the power of keeping before the mind and applying to particular cases general principles of conduct. The last stage of insanity is one of utter feebleness, in which all the intellectual powers are so much prostrated as to reduce the sufferer to a state of imbecility. Lastly, paralysis and epilepsy are so closely allied with insanity, that insanity frequently forms a symptom of each. In all the cases above referred to, the sufferer is supposed to have been originally sane, but sanity may never be enjoyed at all. This happens in cases of idiocy.'

The same writer points out the chief points on which medical and legal writers differ respecting the plea of irresponsibility ('Hist. of Crim. Law of England,' vol. iii. ch. xvii.); and this chapter should be perused by all physicians who have to deal with insane criminals. It may be well to give an outline of the views therein expressed.

'The different legal authorities' (he says, p. 125) 'upon the subject have been right in holding that the mere existence of madness ought not to be an excuse for crime, unless it produces in fact one or the other of certain consequences.' The English law with respect to madness is thus stated, the doubtful points being placed within square brackets: 'No act is crime if the person who does it is at the time when it is done prevented, [either by defective mental power or] by any disease affecting the mind, (*a*) from knowing the nature or quality of his act; or (*b*) from knowing the act is wrong; [or (*c*) from controlling his own conduct, unless the absence of the power of control has been produced by his own default]. But an act may be a crime, although the mind of the person who does it is affected by disease, if such disease does not, in fact, produce upon his mind one or other of the effects above mentioned, in reference to the act.' Speaking of knowledge of right and wrong, he says, 'I think that any one would fall within that description (inability to know the quality of his act) who was deprived, by disease affecting the mind, of the power of passing a rational judgment on the moral character of the act which he meant to do' (p. 163). And again, 'Knowledge and power are the constituent elements of all voluntary actions, and if either is seriously impaired, the other is disabled. It is as true that a man who cannot control himself does not know the nature of his acts, as that a man who does not know the nature of his acts is incapable of self-control' (p. 171).

The true legal meaning of the word 'know,' as applied to madness, is by no means easy to determine; and it is also clear that the term *responsibility* is used in different senses by legal and medical authorities respectively. The lawyer understands by it responsibility to the law of the land; medical writers on insanity, on the other hand, have habitually used the term in a vague and undefined sense as referring to what ought in their opinion to be the law, and as referring to some moral standard. The word *wrong*, too, is used in two senses—it may mean either immoral or illegal.

It is here right to observe that 'irresistible' is a term often applied by medical writers to impulses which can be controlled. Stephen, J., quotes a remarkable instance of a woman who felt what was termed an 'irresistible impulse' to murder her child, and yet did successfully resist her impulse.

Symptoms of Incipient Insanity.—The symptoms by which insanity is indicated at an early stage are liable to great variation, according to the sex, age, and social position of the person. In reference to suicide, the execution of wills, or the perpetration of crime, we often find, after the death of the person, or at the trial which follows the crime, that the most trivial and irrelevant circumstances are brought forward as indications of insanity. This subject has been ably treated by Winslow. ('Obscure Dis. of the Brain,' p. 88.) The facts are there gathered chiefly from the accounts furnished to him by those who have recovered. There is great irritability at the most trifling circumstances —impatience of contradiction, loquacity, great difficulty in directing attention to and steadily occupying the mind with any train of thought, neglect of usual employment, sleeplessness, depression of spirits without reasonable cause, a disposition to seclusion, doubts about personal identity, followed by hallucinations and illusions. A lady, who was gradually affected, remained insane for nearly eleven months: she informed Winslow that during the whole of that time she fancied she was in hell and tormented by evil spirits; she thought every person near her was the devil. Sometimes a patient fancies he is continually watched by spies, that policemen are looking after him, and that conspiracies and plots among his relatives or friends are going on secretly against him; he believes that his food is drugged or poisoned, and will refuse to eat. Great anxiety on any subject followed by headache may be the forerunners of an attack; there is generally an entire loss of interest in the usual occupations, a silent manner, and a great desire for solitude. In one instance fits of immoderate laughter at the most trivial occurrences preceded the attack. Sooner or later these symptoms are attended by perverted taste or smell—by illusions of hearing or sight; voices are heard, and objects are seen, which at first perplex and then confuse the patient; they continue until he feels overpowered mentally and bodily; and he then falls into delusions regarding himself, his friends who are about him, his profession or occupation, and his worldly circumstances.

In incipient insanity delusion does not necessarily exist. There is an antecedent state, in which the most prominent feature is intense *self-conceit.* A man may retain the knowledge of his personal identity, but he may fancy himself to be wiser, richer, or stronger than he really is. Another feature is *misanthropy*, a general dislike to others without cause, but especially directed against those who have the greatest claim on his affection. This feeling may after a time become complicated with some delusion. A third symptom is a *suspicious disposition,* which sooner or later leads to delusion, and the person imagines that there are conspiracies to poison him or to do him some bodily injury. ('Lancet,' 1873, i. p. 471.) Intense self-conceit, misanthropy, and distrust without delusion, may be regarded as the most marked forerunners of an attack of insanity.

Hallucinations and Illusions.—These are the most striking symptoms which are met with in a confirmed state of insanity. Hallucinations are those sensations which are supposed by the patient to be produced by external impressions, although no material objects act upon his sense at the time; illusions, on the other hand, are sensations produced by a false perception of objects. A man has visions of all kinds, including the forms of the dead and the living, floating before him, when he is gazing upon vacancy. He fancies he hears voices speaking or mysteriously whispering to him, while there is profound silence: these are hallucinations. Another may erroneously imagine that the taste or smell of his ordinary food is earthy, metallic, or poisonous—when the perversion is in his own senses: these are illusions. Both conditions depend upon a disordered state of the mind. Instances of hallucination are furnished by the act of dreaming: while illusions occur often during the act of suddenly waking from sleep, giving rise occasionally to serious questions involving criminal responsibility. The state of insanity is in other points of view analogous to dreaming. There is equally a want of power in the two states to change or control the current of thought passing through the mind. Things which are impossible and inconsistent are believed to have an actual existence. A voice heard during the act of dreaming sometimes becomes an illusion connected with a current of thought then passing through the mind; it is the same in a case of confirmed insanity, with this difference in the latter, that some power of will or some exercise of reason may still exist.

Illusions are sometimes met with in the sane, but, when arising from external objects, the false perception is soon corrected by a reference to the other senses; and herein consists the main difference between sanity and insanity—namely, *delusion*, or a misleading of the mind. When the hallucination or illusion is believed to have a positive existence, and this belief is not removed either by reflection or an appeal to the other senses, the person is insane; but when the false sensation is immediately detected by the judgment, and is not acted on as if it were real, then the person is sane. *Delusion*, therefore, properly refers to the judgment, and *illusion* to the senses. The meaning of these terms is often confounded; but while delusion is always connected with insanity, illusion is not necessarily indicative of mental disorder. Hallucinations and illusions are the main features of those forms of insanity which are known as mania and monomania. They are rarely met with in cases of idiocy and imbecility, sometimes in dementia, but they are most common in paroxysms of mania. Acts of murder may generally be traced to their existence; for the person labouring under mania or monomania is unable during a paroxysm to divest his mind of the belief that what he sees has a positive existence before him. He feels impelled to suicide by the hallucination of voices calling to him, and to murder by the illusion that he is not destroying a wife, child, or friend, but an evil spirit substituted for them. The acts of the insane are generally connected with their delusions, although it is not easy to trace the connection except by their own admissions. When the acts are unusual and strange, it is most probable that they depend on hallucination, illusion, or both.

Lucid Intervals.—By a lucid interval we are to understand, in a legal sense, a temporary cessation of the insanity, or a perfect restoration to reason. In a remission there is a mere abatement of the symptoms. It has been said that a lucid interval is only a more perfect remission, and that although the lunatic may act rationally and talk coherently, yet his brain is in an excitable state, and he labours under a greater disposition to a fresh attack of insanity than one whose mind has never been affected. Of this there can be no doubt, but the same reasoning would tend to show that insanity is never cured; for the predisposition to an attack is undoubtedly greater in a recovered lunatic than in one who is and has always been perfectly sane. Even admitting the correctness of this reasoning, it cannot be denied that lunatics do occasionally recover for a longer or shorter period, to such a degree as to render them perfectly conscious of and legally responsible for their actions like other persons. The law intends no more than this by a lucid interval—it does not require proof that the cure is so complete that even the predisposition to the disease is entirely extirpated. Such proof, if it could even be procured, would be totally irrelevant. If a man acts rationally and talks coherently, we can have no better proof of a restoration to reason. If no delusion affecting his conduct remains in his mind, we need not concern ourselves about the degree of latent predisposition to a fresh attack which may still exist. Lucid intervals sometimes appear suddenly in the insane: the person feels as if awakened from a dream, and there is often a perfect consciousness of the absurdity of the delusion under which he was previously labouring. The duration of the interval is uncertain: it may last for a few minutes only, or may be protracted for days, weeks, months, and even years. In a medico-legal view, its alleged existence must be always looked upon with suspicion and doubt when the interval is very short.

Lucid intervals are most frequently seen in cases of mania and monomania; they occasionally exist in dementia when this state is not chronic, but has succeeded a fit of intermittent or periodical mania. They are never met with in cases of idiocy and imbecility. It is sometimes a matter of great importance to be able to show whether or not there exists or has existed a lucid interval, since in this state the acts of a person are deemed valid in law. The mind should be tested, as in determining whether the patient is labouring under insanity or not. He should be able to describe his feelings, and talk of the subject of his delusion, without betraying any signs of unnecessary vehemence or excitement. It may happen that the person who is the subject of a Commission of Inquiry is at the time of examination under a lucid interval, in which case there may be some difficulty in forming an opinion of the existence of insanity. It has been said that a person in a lucid interval is considered by law to be responsible for his acts, whether these are of a civil or criminal nature. In regard to criminal offences committed during a lucid interval, it is the opinion of many alienists that no person should be convicted under such circumstances, because there is a probability that he might at the time have been under the influence of that degree of cerebral irritation which renders a man insane. This remark applies especially to those instances in which the lucid interval is very short. Juries now seldom convict, however rationally in appearance a crime may have been perpetrated, if it is proved that the accused was insane within a short period of the time of its perpetration.

The number of lunatics in England and Wales in 1883 was 78,528, exclusive of 228 so found by inquisition, but including 535 criminal lunatics.

CHAPTER 62.

VARIETIES OF INSANITY.—MANIA.—ABSTINENCE FROM FOOD.—DELUSIONS REGARDING POISON.—DELIRIUM DISTINGUISHED FROM MANIA.—MONOMANIA.—DEMENTIA.—IDIOCY.—IMBECILITY.—HEREDITARY TRANSMISSION. —FEIGNED INSANITY.—APPEARANCES AFTER DEATH.—ECCENTRICITY.

Varieties of Insanity.—Medical jurists have commonly recognized four distinct forms of insanity: *Mania*, *Monomania*, *Dementia*, and *Idiocy* (*Amentia*). This division was proposed by Esquirol, and although of a purely artificial nature, it is convenient for the arrangement and classification of the facts connected with the subject. In some instances there is great difficulty in assigning a particular case to either of these divisions, owing to the circumstance that these states of disordered mind, if we except idiocy, are frequently intermixed, and are apt to pass and repass into each other. On other occasions, a case may represent mixed characters which appertain to all the divisions. *Melancholia* may be regarded as chronic mania. *General paralysis of the insane* is a cause or symptom of insanity, and not a separate division of it.

Mania.—In this form of insanity there is a general derangement or perversion of the mental faculties, accompanied by greater or less excitement, sometimes amounting to violent fury. (Pagan's 'Med. Jur. of Insanity,' p. 59; Marc, 'De la Folie,' vol. i. p. 211.) Ideas flow through the mind without order or connection, the person losing all control over his thoughts, and believing and acting upon them, however absurd and inconsistent they may be. Rapidity of utterance and incessant agitation accompany this state; there is also great irritability, so that not the least contradiction can be borne. Mania may take place suddenly, as after a violent moral shock, but in general it comes on slowly. It may be chronic or acute, recurrent or continued. There are very few cases which do not present remissions, more or less complete; and in some instances after a violent attack, the reason appears to be perfectly restored, forming then what is termed a lucid interval, the clear distinction of which, in a legal point of view, is of material importance. In *recurrent mania* the attack comes on without any obvious cause. It may last for a week, a month, or even longer. There is usually a stage of excitement followed by depression before recovery. Persons labouring under mania, especially when it is associated, as it frequently is, with paralysis, are comparatively insensible to severe injuries. They will bear exposure to cold without complaining, and even conceal the existence of a fracture or other injury which would cause great pain to a sane person. They will also sustain the privation of food for a great length of time without any apparent injury to health. In some instances, owing to a suspicion that the food is poisoned, they refuse to take any; it is then necessary to feed them with a stomach-pump. This delusion respecting the poisoning of food is very common in the early stages of mania. The patient will fancy that he himself, or some favourite animal, is undergoing a process of slow poisoning by a secret enemy. We have met with a great number of instances in which this delusion of being the victim of poison was the principal feature of the mental disorder. In mania there is excitement coming on in paroxysms without any obvious cause, and leading the person to acts of violence either towards himself or others.

It is necessary that a medical jurist should be able to distinguish *mania* from delirium depending on bodily disease, and from the action of poisons. *Delirium* closely resembles the acute form of mania,—so closely that mistakes have occurred, and persons labouring under it have been improperly ordered into confinement as maniacs. The following are, perhaps, the best diagnostic differences: a disordered state of the mind is the first symptom remarked in mania; while delirium is a result of bodily disease, and there is greater febrile excitement in it than in mania. Delirium, being a mere symptom attendant on the disease which produces it, exists as long as that disease, and no longer; while mania, depending on widely different causes, is persistent. Delirium disappears suddenly, leaving the mind clear; while mania commonly experiences only remissions. (See Pagan's 'Med. Jur. of Insanity,' p. 69.) In delirium there is generally great acuteness of the senses. Inflammation of the brain or its membranes is distinguished from acute mania by the mode of its attack, the presence of severe pain in the head, and excessive sensibility with intolerance of light and sound.

Monomania.—This name is applied to that condition in which the mental alienation is apparently only partial; in other words, it is nothing more than insanity manifesting itself in one direction. In mania, the mind is disordered on all kinds of subjects; in monomania, the disorder is confined chiefly either to one subject or to one class of subjects. Monomaniacs are infected with false ideas on certain points, of which they cannot divest themselves, and out of which they cannot be reasoned: they start from false principles, but, setting this aside, their inferences and deductions from these principles often possess logical accuracy. In every subject not connected with their special delusions, they are like the rest of the world; they talk and reason as justly upon facts as before the access of their malady, but, their general deportment, habits, and character are changed. Thus a miser may become a spendthrift, and a hard-working and industrious mechanic may pass his time in idleness; a man of moral habits will become immoral in conversation and conduct, and an abstemious man may become a drunkard.

The monomania may be so slight that the person will have the power of so controlling his thoughts and actions as to appear like one who is sane, provided the subject of his delusion is not referred to. There is no doubt that those who are affected with monomania in an early stage are frequently able to direct their minds with reason and propriety to the performance of their social duties, so long as these do not involve any of the subjects of their delusions. Their power of controlling their thoughts and feelings, as well as of concealing their delusions, implies a certain consciousness of their condition not usually met with in mania; and it also appears to imply the existence of such a control over their conduct as to render them equally responsible with sane persons for many of their acts. In a case of confirmed monomania, however, it is not to be supposed that a man is insane upon *one* point only, and sane upon all other subjects. The only admissible view of this disorder is that which was taken by Lord Lyndhurst, in one of his judgments. In monomania the mind is unsound; not unsound in one point only, and sound in all other respects, but this unsoundness manifests itself principally with reference to some particular object or person. There is no doubt that all the mental faculties are more or less affected, but the affection is more strikingly manifested in some of these than in others.

The delusion of a monomaniac will be generally uppermost in his mind; his will is powerless to dismiss it, just as in mania the will is powerless to stop the continuous and rapid succession of different and incongruous ideas which present themselves to the mind in that form of insanity. In the first stage of monomania, the judgment may be strong and the mind apparently sound upon every point except the particular subject of delusion; and even, in some instances, there may be such a control over this delusion, that it would be difficult to discover whether or not there was any just ground for imputing mental unsoundness; but in a more advanced form of the disease, the delusion, whatever it may be, whether relating to wealth, ambition, religion, or politics, so overpowers the patient that he loses self-control. His character is changed, and his habits are such as to render him unfit for social intercourse; he becomes incoherent; his ideas are perverted on all subjects, and he gradually lapses into mania or dementia. The last condition happens when the monomania is of long standing. Monomania may be remittent or intermittent, and it is sometimes accompanied with lucid intervals. Its progress is rapid, and its termination often unexpected; in some instances the disease ceases suddenly without any previous warning, owing to the effects of a strong moral shock or impression.

Monomania, in its early stage, is liable to be confounded with *eccentricity;* but there is this difference between them. In monomania there is obviously a change of character,—the person is different from what he was; in eccentricity such a difference is not remarked,—he is, and always has been, singular in his ideas and actions, there is no observable change of character. An eccentric man may be convinced that what he is doing is absurd and contrary to the general rules of society, but he professes to set these rules at defiance: a true monomaniac cannot be convinced of his error, and he thinks that his acts are consistent with reason and the general conduct of mankind. In eccentricity there is the will to do or not to do; in real monomania the controlling power of the will appears to be lost. Eccentric habits suddenly acquired are, however, presumptive of insanity. It will be seen hereafter that the distinction of these states is of considerable importance in relation to testamentary capacity.

Monomania frequently assumes one of two forms: either the thoughts are lively and gay, or they are oppressed with gloomy melancholy. In the first state, the persons will fancy themselves to be kings and queens, and overflowing with wealth, which they are prepared to distribute with regal profusion; in the second state, we find silence, seclusion, and the most heart-rending sorrow. The latter condition, by no means uncommon as a form of monomania, is called *Melancholia* (mania with depression), or *Lypemania* (*λύπη, sorrow*). Those who are affected with it suppose they have committed the unpardonable sin, and pass their hours in silence and in the most gloomy forebodings of eternal punishment. They do not sleep, will sometimes neither eat, speak, nor move; and force must be used to make them take food and exercise. In some instances no persuasion can conquer their silence; one patient thus affected was not heard to utter a word during four years. If spoken to, they shed tears and violently repulse the person who addresses them. Melancholia frequently leads to an act of suicide or murder, and persons affected with it require close watching. In the lighter forms of the disease there is no sign of mental aberration, and the patient will go through his usual routine of duty, but always with the same desponding air; so that his occupation seems scarcely to distract his thoughts from the delusion for a single instant. In other cases the delusion is so well concealed that no suspicion exists, until an act of suicide leads to inquiry, and some evidence of strangeness of conduct is then for the first time forthcoming. There is either an entire absence of motive for the act, or the motive is based on a delusion.

Dementia.—This is a state which, although sometimes confounded with mania, is very different in its characters. Dementia, when confirmed, consists in a total absence of all reasoning power, and an incapacity to perceive the true relations of things; the language is incoherent, and the actions are inconsistent; the patient speaks without being conscious of the meaning of what he is saying; memory is lost, and sometimes the same word or phrase is repeated for many hours together; words are no longer connected in meaning, as they are in mania and monomania. This state is often called *Fatuity;* it is a not unfrequent consequence of chronic mania.

Dementia varies in degree. The disordered mind of aged persons is one form of dementia; here we find memory and some mental power, although the memory is restricted to objects long since past, and the exertions of the mind are only momentary. Some persons in dementia are quiet, others are in constant motion as if in search of something. In some instances this disease comes on gradually—the faculties, both moral and intellectual, decay one by one; while in other instances, although much more rarely, dementia may occur suddenly from a violent shock or impression on the mind. Dementia may be acute or chronic, remittent or intermittent. The countenance of the patient is generally pale, vacant, and without expression, the look vague and uncertain, and tears are abundantly shed from the slightest causes.

The following may be taken as the most striking differences between mania and dementia. In mania there is an incoherence of ideas, but depending on too great rapidity of thought and excitement of the intellectual powers; in dementia there is a want of ideas, and the incoherence depends on the loss of the power of connecting them, owing to defect of memory; volition is lost and the brain seems in a state of collapse. (Esquirol, 'Mal. Ment.,' vol. 2, pp. 224 and 232.) In fact, in dementia there is a more or less complete abolition of the moral, intellectual, and voluntary powers; in mania, and also in monomania, they are in a state of perversion. Dementia is often a consequence of these states, and sometimes alternates with them.

Idiocy. Imbecility.—Idiocy is the *dementia naturalis* of lawyers. The term 'idiot' is applied to one who from original defect has never had mental power. Idiocy differs from the other states of insanity in the fact that it is marked by a congenital deficiency of the mental faculties. There is not here a perversion or a loss of what has once been acquired, but a state in which, from defective structure of the brain, the individual has never been able to acquire any degree of intellectual power to fit him for his social position. It commences with life, and continues through it, although idiots are said rarely to live beyond the age of thirty. (Esquirol, 'Mal. Ment.,' vol. 2, p. 284.) The deficiency of intellect is marked by a peculiar physiognomy, an absence of all expression, and a vague and unmeaning look; there is no power of speech, or only the utterance of a cry or sound; there is no will, but the actions of these beings appear to depend upon impulse, a power of imitation, or mere animal instinct; they recognize no one, they remember no one, and the mind seems to be a blank. Such is the picture of what may be termed a complete idiot. This state of idiocy is often accompanied with great bodily deformity and enlargement of the thyroid gland (goître), both in males and females; it is there termed cretinism. A confirmed idiot may in almost all cases be recognized by the expression of countenance and the form of the skull.

Idiocy is not always so complete as this description implies. There is a state, scarcely separable from idiocy, in which the mind is capable of receiving some ideas, and of profiting to a certain extent by instruction. Owing, however, either to original defect, or to a defect proceeding from arrested development of the brain as a result of disease or other causes operating after birth, the minds of such persons are not capable of being brought to a healthy standard of intellect, like that of an ordinary person of similar age and social position. This state is called *imbecility*; it is nothing more than idiocy in a minor degree. In common language, persons labouring under it are often called idiots, but for the sake of precision in medical language they are more correctly described as imbeciles. (Esquirol, op. cit., vol. 2, p. 289.) In imbecility, the physical organization differs but little from the ordinary standard; the moral and intellectual faculties are susceptible of cultivation, but to a less degree than in a perfect man, and even this capacity does not exist beyond a certain point. Imbeciles never attain a normal standard of intellect, and when placed in the same circumstances as other men, they never make a similar use of their intellectual powers. They can form no abstract ideas, and sometimes their capacity to receive instruction is restricted to a certain subject—as, for instance, arithmetic. Their memory and judgment are limited, although sometimes the former is remarkably strong. They express themselves in a hesitating manner, and differently from other men; they require time to perceive the relations of objects which are immediately perceived by sane persons. The degree in which imbecility exists is well indicated by the power of speech. In idiots there is no speech, or only an utterance of single words; in the better class of imbeciles the speech is often easy and unaffected, while there is every grade between these two extremes. Some have arranged imbeciles in classes, according to their capacity to receive instruction, others according to their power of speech; but such divisions are practically without value: each case must be judged by itself. The precise boundary between idiocy and imbecility cannot be defined. The major degrees of imbecility approach so closely to those of idiocy that there is no distinction between them, and in a practical view no distinction is required. Idiocy has been here described as that condition in which the congenital effect is not susceptible of being removed by any kind of instruction; but many medico-legal writers apply the term 'idiot' to one who does manifest capacity to receive instruction, although in a low degree. The difference is immaterial so long as the meaning of the word is understood.

How are the minor degrees of imbecility to be distinguished from sanity? This is a question by no means easy to answer, for the reason that sane persons differ remarkably in their mental power to receive instruction, to retain what they have been taught, and to allow them to make a practical use of it in the world for their own benefit. Many persons pass through life and advance in the world who are yet undoubtedly weak-minded, and who have the reputation among all who know them of being so. The truth is, the lowest degrees of intelligence legally constituting sound mind, are not separable from the minor forms of imbecility, so far as the moral and intellectual faculties are concerned.

Idiocy and imbecility must not be confounded with mania and monomania. In idiots and imbeciles ideas are wanting, and the power of thought is absent or defective; in maniacs and monomaniacs the ideas flow freely, but they are perverted, and the power of thought is irregular and uncontrolled. In idiocy and imbecility we do not meet with the hallucinations and illusions which constitute the main features of mania and monomania. Idiocy is much more likely to be confounded with dementia, and indeed, when dementia is confirmed and complete (*fatuity*), there is no appreciable difference, for in neither state is there any evidence of the exercise of mental power. In idiocy, no ideas have ever been formed; in imbecility, they have been partially formed, but arrested; in dementia, they have been more or less completely formed, but have subsequently become entirely obliterated. It is important to remember that in idiocy and imbecility there is no gradual loss or sudden impairment of the mental faculties, as is generally observed in dementia; the person is what he always has been — mentally weak and unsusceptible of any great degree of improvement by instruction.

From these remarks it will be perceived that imbecility is a state existing from birth or from childhood—for it is possible that it may supervene from disease after birth, in a child in whom there was no reason to suspect its existence—but it is more common to find the deficiency congenital. Still, the term is often applied to that weakness of the mental powers which takes place in the aged at the close of life, even when the mind has been well developed in maturity. Thus we speak of the imbecility of age: this is truly nothing more than a state of *senile dementia,* and to apply to it the term 'imbecility' tends to create confusion.

In the first decennial Revision of the Nomenclature of Diseases drawn up by the Royal College of Physicians of London, idiocy is made synonymous with congenital imbecility, and dementia is made to include acquired imbecility; imbecility *per se* having no recognition. It is also stated that cases of monomania should be named according as the prevailing symptoms are those of mania, melancholia, or dementia.

Such, then, are the forms under which insanity or mental aberration may present itself to our notice, and although there are mixed states, as of mania and dementia (*incoherency*), yet it is an important feature in the distinction of mental disorders, to observe that in intellectual insanity the characters presented to us in any given case, do not vary materially from those which have been described as peculiar to each of these states. This classification, it must be remembered, is made for the sake of convenience, because by it a medical practitioner may be led to form a safe diagnosis of the real state of mind of a person. It is not recognized in any of the law proceedings connected with the insane; for in these the term *unsoundness of mind*—comprehending lunacy, idiocy, imbecility, and all forms of mental weakness—is almost exclusively employed. In adopting this arrangement, a medical jurist must take care not to fall into an error which has been sometimes committed—*i.e.* of pronouncing a person to be of sound mind, because his case could not be easily placed in any one of these four great divisions of insanity. This would be as serious an error as that formerly committed by some law authorities—namely, of giving restricted and incorrect definitions of lunacy, idiocy, and imbecility, and then contending whoever was not a lunatic, idiot, or imbecile according to these arbitrary legal definitions, must be a person of sound mind.

Hereditary Transmission.—The hereditary transmission of insanity often presents itself as a medico-legal question in relation to the criminal responsibility of the insane. In *Reg.* v. *Ross Touchet* (1844), in which the accused was tried for shooting a man, and acquitted on the ground of insanity, Maule, J., held that evidence that the grandfather had been insane might be adduced, after it had been proved by medical testimony that such a disease is often hereditary in a family. It was also admitted in *Oxford's* case, the prisoner having been tried for shooting at the queen ('Law Times,' Oct. 26, 1844); and since that date it has been admitted in a great number of cases in which insanity was urged as a defence on a charge of murder. This kind of evidence has, however, been frequently rejected.

Feigned Insanity.—Insanity is sometimes feigned by persons accused of criminal offences in order to procure an acquittal or discharge. In the first place, when feigning is suspected, it will be proper to inquire whether the person has any *motive* for pretending to be insane. No sane person feigns without a motive. It is necessary to remember that insanity is never assumed until *after* the commission of a crime and the actual detection of the criminal. No one feigns insanity merely to avoid suspicion. In general, as in most cases of imposture, the part is overacted—the person does either too much or too little, and he betrays himself by inconsistencies of conduct and language which are never met with in cases of real insanity. There is commonly some probable cause to which insanity may be traced, but when the malady is feigned there is no apparent cause; in this case the appearance of the assumed insanity is always sudden—in the real malady, the progress of an attack is generally gradual; and when the attack is really sudden, it will usually be found to be due to some great moral shock or other very obvious cause. We should observe whether for some time previously there has been any marked change of character in the person, or whether his conduct, when he had no interest to feign, presented any of the usual indications of a disordered mind. Some difficulty may arise when fits of eccentricity or strangeness of character are deposed to by witnesses; but these statements may be inconsistent with each other, and the previous acts of the person may bear no resemblance whatever to those performed by him in the recently assumed condition. A difficulty of this kind rarely presents itself, since in an impostor no act indicative of insanity can be adduced for any antecedent period of his life: it is only *after* the perpetration of a crime and its detection, that any action simulating the habits of the insane will be met with. In real insanity, the person will *not* admit that he is insane; in the feigned state all his attempts are directed to make others believe that he is mad; and an impostor may be induced to perform any act, if it be casually observed to another in his hearing that the performance of such an act will furnish strong evidence of his insanity.

Mania is perhaps more frequently assumed than any other form, because the vulgar notion of insanity is that it is made up of violent action and vociferous and incoherent language; but mania rarely comes on suddenly, or without some obvious cause. A maniacal patient is equally furious day and night, while an impostor is obliged to rest after his violent exertions. Burrows recommends that close attention should be paid to the expression of the eye. The mobility of the features may be as rapid as the imagination is vivid; but when every feature may vary, or be kept under control and be steady, the eye will still indicate the erring thought—its expression cannot be easily assumed. There is about the eyes in mania a restlessness which cannot fail to attract attention; the patient sleeps but little, and the sleep is disturbed—an impostor sleeps as soundly as a healthy person. The violence of a maniac continues whether he is alone or not, while the impostor acts his part only when he thinks he is observed: hence the imposition may be detected by watching him unawares.

The feigning of *monomania* is a matter of some difficulty; it would be easily susceptible of detection. As in mania, the part would be overacted, and an impostor would thus betray himself. *Dementia* is more easily feigned: in general, this state comes on slowly, and is obviously dependent on organic changes, as old age, apoplexy, paralysis, or hemiplegia; or it is a consequence of recurrent mania or monomania. *Idiocy* and *Imbecility* could hardly be feigned successfully, because these are states of congenital deficiency; they must have existed from birth, of which, of course, there would be some evidence. Among modern cases in which dementia was alleged to have been feigned is that of *Lady Mordaunt.* (*Mordaunt* v. *Mordaunt*, Divorce Ct., Feb. 1870.) In consequence of a confession made by this lady soon after her confinement, that she had committed adultery with certain persons, her husband took proceedings against her for a divorce. At the date at which she was served with notice of the writ, April 30, 1869, it was alleged that she was insane, and that from mental incapacity she was unfit or unable to instruct an attorney for her defence. On the part of the husband, it was alleged that she was really fit and competent, and that the state of insanity was assumed in order to avoid the exposure of a public trial. The jury, upon hearing a large amount of evidence from medical experts and others, found that this lady was labouring under 'mental disorder,' and that she was incompetent to give instructions for her defence.

On the simulation of insanity, see a paper by Laurent. ('Ann. d'Hyg.,' 1866, t. 2, p. 460.) He advises the complete isolation of the person, with daily watching for a certain time, as a method which seldom fails to detect the imposition, while it cannot injure the really insane. One remarkable circumstance he points out, namely, the influence of feigning insanity on the feigner. He is of opinion that persons who have for some days or weeks pretended that they were mad have become so in the end. In support of this view he quotes the cases of two sailors who had feigned madness in order to escape imprisonment in the hulks. The imposture was at first successful, but in the end it had an unfortunate result, for they became really mad. An impostor must be ever on the watch that he does not fail on any one point. This creates a great strain on the mind, and as a result of the anxiety attendant on the maintenance of such an imposition at all times and under all circumstances, he may suffer from cerebral exhaustion with its worst consequences.

Appearances after Death.—In some cases a medical practitioner may be required to state whether certain appearances found in the brain of a deceased person do or do not indicate the past existence of insanity or imbecility. Such a question is only likely to arise in chronic cases, in which the past existence of insanity from oral testimony may be disputed. (Case of *Stulz*, Prerog. Court, 1852.) The appearances commonly met with on an inspection of the head may be—thickening of the bones of the skull, close adhesions of the dura mater (the lining membrane), with great congestion of the pia mater, and opacity and thickening of the arachnoid or inner membrane of the brain. There is a general fulness of the blood-vessels of the brain, with remains of old cysts, hardened deposits, or even abscesses in various parts of the cerebral substance. Inferences from the existence of these appearances in the brain must, however, be drawn with caution, because it cannot be said that they necessarily indicate insanity; nevertheless, such chronic changes must be considered as likely to produce greater or less derangement of the mental functions; but the actual degree in which the impairment is alleged to have existed ought properly to be determined by actions of the deceased during life. But, as Savage has truly said, 'One of the greatest difficulties which has ever presented itself to the student of insanity has been the fact that, *post mortem*, so little has been found visible to the naked eye. I may say that, with my experience of years, and after seeing many hundreds of *post mortem* examinations of bodies of the insane, I have met with few coarse changes within the skull, and even with the higher powers of the microscope all that can often be detected may be evidences of change in the nutrition of the connective tissue of the brain.' ('Insanity,' p. 9.)

In the case of *Roberts* v. *Kerslake* (Warwick Aut. Ass., 1854), the main question was whether certain appearances in the brain and its membranes did or did not indicate disease of long standing as well as insanity at the particular date at which a will was made. Conolly and the author considered that the appearances were not inconsistent with the supposition that the testator was sane at the time of making his will. ('Jour. Psych. Med.,' Oct. 1854, p. 573.)

CHAPTER 63.

MEDICO-LEGAL QUESTIONS IN RELATION TO THE INSANE.—REGULATIONS OF LUNATICS.—APPLICATION OF RESTRAINT.—ILLEGAL IMPOSITION OF RESTRAINT.—VIOLENCE OF TEMPER.—CERTIFICATES OF INSANITY.—RULES FOR THE DISCHARGE OF LUNATICS.—NULLITY OF MARRIAGE.

THE legal relations of lunacy are regulated by an executive, at the head of which is the Lord Chancellor, subject to whom all those who have jurisdiction in lunacy act. Appeal from any decision of his is made to the Court of Appeal. Under the control of the Lord Chancellor are two Masters in Lunacy, who must be barristers of ten years' standing, a registrar, and three visitors, one of whom must be a barrister of five years' standing, and two of them physicians in actual practice at the time of their appointment, but debarred from subsequent practice. These officers have to deal with Chancery lunatics, determining whether such private individuals are sane and capable of managing their affairs or not, by means of a *Commission in Lunacy*, a term not to be confounded with *Commissioners in Lunacy*. This last body consists of eleven persons, five of whom, including the permanent chairman, are unpaid; the remainder, three barristers and three physicians, are paid. The Commissioners in Lunacy have nothing to do with Commissions in Lunacy. The Commissioners in Lunacy regulate the affairs of asylums and action with respect to public lunatics and such private lunatics as are not Chancery lunatics. Public lunatics—criminal and pauper lunatics—are kept, the former in Broadmoor Criminal Lunatic Asylum, and the latter in pauper asylums and (generally illegally, according to a recent legal decision) in workhouses. Private lunatics may be detained in registered hospitals, licensed asylums, or retreats, and, under certain conditions, in private houses which are to be licensed. No medical man may receive a lunatic into his house for treatment except the house be duly licensed.

Among the questions which may come before a medical jurist in relation to the subject of insanity are the following:—A practitioner may be required to say whether a person affected with the malady should or should not be confined in an asylum; whether he should be deprived of his civil rights by interdiction; or whether he is so completely cured of his malady as to justify his liberation from confinement. Then, again, medical evidence may go far to determine whether a will or deed executed by an alleged lunatic should be set aside; whether a marriage contract (*Hunter* v. *Hunter*, otherwise *Edney*; *Durham* v. *Durham*, otherwise *Milner*; *Cannon* v. *Cannon*) or debt should be annulled; and lastly, whether a criminal act was committed by a person while labouring under insanity—a question involving either the life, or, according to circumstances, the perpetual imprisonment of a person accused of crime.

Application of Restraint.—By restraint, in a legal sense, we are to understand the placing of attendants to watch or control the actions of an alleged lunatic, or his forcible removal from friends or relatives with or without the confinement of his person by physical force. What are the circumstances which will justify a practitioner in applying restraint to the insane? The law has given great power in this respect to members of the medical profession, but, owing to certain abuses, the power has been of late years much restricted by various Acts of the Legislature. Most medico-legal writers agree that we are not justified in ordering restraint except when, *from symptoms* witnessed by ourselves, we have reason to apprehend that *the lunatic will injure himself or others in person or property.* It is then not sufficient to seek merely for evidence of the existence of some *delusion*, but to determine how far that delusion, if present, affects the conduct of the person. The real question is whether we have reason to apprehend *imminent danger.* Unless the delusion is such as to render it probable that the patient or his friends may be injured by his insane conduct, careful superintendence will answer all the purposes of the closest restraint. The act of resorting to restraint on all occasions has been justified on the principle that it may tend to the cure of a patient by removing his delusion. In this point of view the subject has reference to medical practice, and not to legal medicine. It may be urged with more plausibility that, by withholding restraint in incipient cases, mischief may be done by the lunatic to himself or others, and that then it will be too late to interfere; but even here careful superintendence may render close confinement unnecessary.

The legal rule for interference with the liberty of a person, which restraint always implies, may be inferred from the following statement by Stephen, J.: 'There is a normal state in which all human creatures act on the same principles, and the general meaning of sanity is that the person conducts himself in this normal manner; that he is acquainted with the circumstances by which he is surrounded; that he has objects in view in his actions; and that he regulates his conduct with reference to them and to the general considerations which affect matters of that class.' ('General View of the Crim. Law of England,' pp. 87, *et seq.*) It cannot be too strongly impressed on the mind of a medical man that, before he employs the powers conferred upon him by law, to confine a person who is said to be mad, he should well consider what lawyers imply by the term 'madness,' in a practical sense. As defined by Stephen, J., it means *conduct* of a certain character—not as it is usually interpreted by medical men, a certain *disease* of the brain the existence of which is speculative, but one of the effects of which, if present, is to produce such conduct. In examining an alleged lunatic, with a view of determining whether he should or should not be placed in confinement, his conduct must therefore be compared with that of other men, and more especially with his own conduct, in a normal state; and here, in order to constitute sane behaviour, we must look for a generic and not for a specific resemblance. Any degree of ignorance, vice, or folly is perfectly consistent with sane conduct in a legal sense. The power of restraint is not intended to be applied to such cases as these; they are properly under certain circumstances amenable to the criminal law. An ignorant, vicious, or foolish man may do a great amount of mischief, but he has a liberty of choice and freedom of action; and if from folly or depravity he selects a bad course, he is not therefore insane, but is as much responsible for his actions as a sane man who prefers a good course. Such a man should not be treated as a lunatic or confined in an asylum under a medical certificate. It may be sometimes difficult to define the line which separates acts of depravity from those of insanity; but medical men have not been in many cases sufficiently cautious in endeavouring to make a distinction. Lawyers look closely to *conduct* as the chief ground of interference with personal liberty; the conduct must be such as to be inconsistent with the usual behaviour of a normally sane person placed under similar circumstances.

In examining a person proposed to be placed under restraint, we must take care not to confound acts depending on *violence of temper* with those which proceed from unsoundness of mind. A man may have always had a violent temper, subject to occasional fits of aggravation; but this condition must not be mistaken for mental disease. In order to determine whether the acts of a person be due to violent temper or insanity, it will be proper to ascertain what may have been his natural habits. The great feature of insanity is *change of character*—a man who is really insane is different from what he has previously been; but it may be proved of a violent-tempered man that he has always been the same. The greatest abuses of the restraint system have been chiefly observed in respect to monomania, where persons have been forcibly imprisoned and confined in asylums, because they entertained some absurd delusions, over which, however, they had so great a power of control as to render it somewhat difficult even for a shrewd and experienced examiner to detect them. When at last, after many hours' cross-examination, the existence of a delusion has been made apparent, the result has been looked upon as furnishing matter for triumph and exultation; but, as Conolly justly remarks, one point in these cases appears to have been wholly lost sight of, namely—What possible injury could have resulted to the patient or his friends from the existence of a delusion over which he had such complete control and mastery as to render it a most laborious task to obtain any evidence whatever of its existence? It may be freely admitted that where delusion does exist, there is reason to suppose that the mind must be more or less disordered in all its faculties; but such patients require only close watching, not a rigorous imprisonment in an asylum. The greatest danger is to be apprehended in those cases in which there is the least power of self-control. The forcible removal of a person from his or her home to a lunatic asylum, unless the circumstances are of such a nature as to render immediate interference necessary on the ground of admitted or proved insanity, is unjustifiable in law, and may involve those concerned in the removal in a serious responsibility. In cases of incipient insanity, such interference would not be legally justifiable, and a practitioner placing restraint on a person so situated, might find himself a defendant in an action for damages.

In *Hill* v. *Philp*, the judges decided that a medical man, when called upon to give a certificate for the confinement of a person, may act upon the directions of a wife, but that the directions must be considered as only guiding his judgment, and not as absolutely dictating to him and justifying his proceedings; that he is still bound to exercise his own professional knowledge and discretion, so far as to refrain from doing anything or adopting any course which might be injurious to the patient. A medical man is, therefore, ultimately responsible for his treatment of a lunatic: no person can give him authority to do that which is not in accordance with medical practice or the necessity of the case. (For a report of this case, and some judicious remarks upon the decision, see 'Legal Exam.,' 1852, pp. 307, 318.) In *Scott* v. *Wakem* (Guildford Sum. Ass., 1862), a medical practitioner was sued for damages in placing under restraint and without necessity or authority, a man labouring under delirium tremens. In this case the wife denied that she had given any authority for interference, and on this point her evidence conflicted with that of the defendant, the medical man whom she had consulted. Fortunately, the facts proved were adverse to her statement; but in future cases of this kind, it would be desirable for a medical man to have a written authority for such proceedings, bearing in mind that he does not exceed what is necessary, proper, or usual for the treatment of the person; and on this he must always exercise his own judgment, irrespective of the opinions or suggestions of others. Medical men, even when acting most conscientiously in the discharge of their duties, cannot hope to escape harassing and vexatious actions when they are called upon to deal with cases of delirium tremens. The peculiarity of this disorder is that, with the cause, it may soon disappear, and thus medical evidence may be easily procured to show that the person was in a sane state of mind and not in a condition to justify any interference with his personal liberty, either a short time before or after the imposition of restraint.

The recent series of decisions in favour of *Mrs. Weldon* in her actions against Semple for certifying insanity, and Winslow for receiving her into his private asylum on the representation of her husband, should convey a caution to medical men not to place undue credence in the statements of interested relatives as to the insanity of an individual. As Blandford pertinently remarks, madmen have an unpleasant way of revealing family secrets, and it is convenient to call such revelations delusions; and it is well, if possible, to derive independent information from others who are not primarily concerned in the patient, rather than from interested relatives.

In order to provide for the protection of lunatics and for the prevention of undue violence or frequency in the application of restraint, the law compels the keepers of asylums to enter in a book a report of each case or of each occasion on which any mechanical restraint is resorted to. An omission to make this entry is a misdemeanour; and at the Maidstone Lent Ass., 1851, two medical men were convicted and fined for placing patients under restraint without having made the entries required by law. (*Reg.* v. *Maddock*; see also 'Lond. Med. Gaz.,' vol.

xlvii. p. 556; and a paper on the 'Use and Abuse of Restraint,' in the 'Jour. Psych. Med.,' 1849, p. 240.)

Certificates of Insanity.—It will here be necessary to state the circumstances which require the attention of a practitioner when he is called upon to sign a certificate of insanity, whereby a person may be placed in confinement in an asylum. The Acts which specially refer to this subject are the 16 & 17 Vict., cc. 96 and 97. These Acts are a consolidation of the statutes on the regulation of the care and treatment of lunatics. Their provisions are very stringent, both with respect to medical men who sign certificates, and those who keep asylums for the reception of lunatics. According to c. 97, s. 74, no person (not a pauper) can be received into or detained in any asylum without an order from some person (generally the nearest relative) and two medical certificates, which must be signed *by two physicians, surgeons, or apothecaries* not in partnership or an assistant to the other, and each of whom shall *separately from the other* have personally examined the person to whom it relates not *more than seven clear days previously* to the reception of such person into such asylum. These certificates need not be filled up, signed, and dated on the day of examination; but the examination of the patient must be made in every case *within seven clear days* before admission.

It follows that no certificate is valid if signed (*a*) by a non-registered practitioner; (*b*) by the partner or assistant of the person signing the other certificate; (*c*) by the person who signs the order (for admission), or by his father, brother, son, partner, or assistant; and lastly, that a certificate becomes invalid and useless if the reception does not take place within seven clear days from the day of the medical examination on which the certificate is granted.

The following is the form of a medical certificate in the case of private patients:—

I, the undersigned, being a duly qualified registered practitioner, and being in actual practice as a physician (surgeon or apothecary), hereby certify that I, on the day of 18 at in the county of separately from any other medical practitioner, personally examined of and that the said is a lunatic (idiot, or person of unsound mind), and a proper person to be taken charge of and detained under care and treatment, and that I have formed this opinion upon the following grounds, viz.:

1. Facts indicating insanity observed by myself:
2. Other facts (if any) indicating insanity, communicated to me by others (stating the name in full of the person giving the information):

(Signed) Name,
Place of abode,

Dated this day of , One thousand eight hundred and

Under c. 96, s. 10, no person can be received into any registered hospital or licensed house, or as a single patient, under any certificate which purports to be founded only upon facts communicated by others. A medical certificate may be amended if incorrect or defective. No medical man can receive as a boarder in his house any insane person, whether for medical treatment or otherwise, unless he has previously obtained a licence from the Commissioners in Lunacy, and one certificate duly signed by two other medical men. The certificate is invalid if signed by the person who takes the charge, or who receives a percentage on, or is otherwise interested in, the payments for the patients. No medical man can receive a single patient into his house on a certificate signed by himself, or by his father, brother, son, partner, or assistant. A medical practitioner was convicted of misdemeanour for thus receiving illegally a lunatic patient. (*Reg.* v. *Kelly*, C. C. C., Jan. 1861.) This was a clear breach of the regulations. The defence was that he was ignorant of the law, but this was no answer to the charge. ('Med. Times and Gaz.,' 1861, i. p. 105; and 'Lancet,' 1861, i. p. 151.)

Great numbers of the certificates which are given with respect to private patients are incorrectly filled up, notwithstanding the plainness of the instructions. The omission of particulars apparently of no importance has often caused them to be rejected as illegal; and it will therefore be useful to point out the chief errors that are committed by medical men. First, a neglect in stating whether the medical practitioner practises as a 'physician,' 'surgeon,' or 'apothecary;' 'general practitioner' will not do. Second, omitting the address of the house at which the examination was made. If there should be no number to the house, it will be sufficient to state, 'At the dwelling-house of ——, in —— street, village, &c.' Third, omitting the address and occupation of the person examined. Fourth, the name of the person communicating the 'other facts.'

By c. 96, s. 13, a medical practitioner who gives a false certificate, or any person not being a *registered* physician, surgeon, or apothecary in actual practice, who gives a certificate as such, is declared to be guilty of a misdemeanour. For any act done by a registered medical practitioner contrary to any of the provisions of the Act (although not declared to be a misdemeanour), he is subjected for each proved offence to a penalty of twenty pounds. By s. 36, the words 'physician,' 'surgeon,' or 'apothecary' shall respectively mean one duly 'licensed or registered to practise as such by or as a member of some College, University, Company, or Institution, legally constituted and qualified to grant such authority or licence in some part of the *United Kingdom*, or one who was in practice as an apothecary in *England* or *Wales* on or before the 1st day of August, 1815, and being in *actual* practice as such physician, surgeon, or apothecary.' (16 & 17 Vict., c. 96, s. 36.) The certificates of Irish medical practitioners, provided their names are on the register, are valid for the confinement of lunatics examined in England and Wales, and those of registered English practitioners are valid for the reception, in asylums, of lunatics examined in Ireland. There is a special Act for Scotland (20 & 21 Vict., c. 71); and by sections 34 and 35 the rules regarding these certificates are similar to those of the English statute.

The Commissioners in Lunacy have issued the following rules for the medical examination of alleged lunatics: 'The patient must not be medically examined in the house where he is to remain, nor on the premises. Should he have been living in the house previously to legalizing the charge, the date of admission given in the notice of admission should be that of the day whereon he returns to the house after signature of the order, medical examinations, and signature of the certificates.

'Should it become necessary to obtain fresh certificates, the patient should, as above, be removed for examination. In this case, and where a fresh order has been required, a fresh notice of admission must be transmitted.

'Certificates signed, or founded on medical examinations made, elsewhere than in England or Wales (the extent of the Commissioners' jurisdiction), are not accepted as a valid authority for the detention of a patient within that jurisdiction.'

A medical practitioner must not be too ready to lend himself to the signing of certificates for the confinement of persons who may be labouring under harmless delusions. In violent mania, or in monomania with a homicidal or a suicidal propensity, there can be no doubt of the propriety of applying some degree of restraint, for here the necessity is imminent. If a remarkable change has suddenly taken place in the character of a person; if he has become irritable, outrageous, or threatened personal violence to any one; or if he has recklessly endangered the interests of himself and family,—he is undoubtedly a fit subject for confinement. The more he approaches to this condition, the less difficulty we shall have in coming to a decision, and in a really doubtful instance there will be no impropriety in employing temporary restraint; since, although the person is thereby deprived of liberty, it is better that this should happen than that he or his friends should incur the risk of suffering severely by his insane conduct.

The 74th section of cap. 97 provides that, in cases of emergency, a person (not a pauper) may, under special circumstances (these being stated in the order), be received into a house or hospital upon a certificate signed by *one* medical practitioner only, provided that within *three days* two other such certificates are signed by two other medical practitioners not being connected with such house or hospital, upon a like examination. The detaining of a person upon one medical certificate only beyond the period of three days, without such further certificates, is a misdemeanour in the keeper of the house or hospital. By c. 97, s. 67, the certificate of *one* medical practitioner only, signed according to the above rules, will suffice for a *pauper lunatic*, provided the person has been previously examined by a justice, clergyman, and overseer or relieving officer. By c. 96, s. 12, no medical practitioner who is interested in or attends a licensed house or hospital, or whose father, brother, son, partner, or assistant is wholly or partly the proprietor of, or a regular professional attendant in, such house or hospital, shall sign any certificate for the reception of a patient into it. It is obvious from the terms of the Act that one person cannot sign a certificate as a substitute for another, and yet there have been several instances of its violation under these circumstances. In 1855 a medical assistant was committed for trial because he had signed the name of the surgeon with whom he was living, to a certificate of insanity for the confinement of a pauper lunatic. There was no doubt about the insanity of the person, and the plea urged in defence was that the surgeon whose name was thus forged was in ill health and had given the assistant an authority to sign papers for him. This, however, was no justification for a violation of the terms of the Act: the words of the certificate are so explicit on this point that no reasonable person can have any doubt about their meaning. In *Reg.* v. *Ogilvy*, C. C. C., Sept. 1872 ('Lancet,' 1872, ii. 354, 467, 499), the defendant was fined fifty pounds for unlawfully signing a medical certificate by representing that he was a *registered* medical practitioner when his name was not on the register. In another case which occurred in 1872, proceedings were taken against a medical man under the following circumstances. He signed a certificate for the confinement of a woman really a lunatic, stating that he had seen and personally examined her on Aug. 9, 1872, although he had not seen her since March, 1859. Further, it was proved that the certificate was signed on Sept. 10, but dated Aug. 9. The medical man pleaded guilty, and was fined ten pounds. These glaring examples of a departure from the explicit terms of the Act relating to lunatics should convey a caution to medical men that they cannot with impunity infringe the strict letter of the law.

As ignorance of the law is not allowed to be an excuse for its violation, so a medical man, unless acquainted with all the particulars above mentioned, may easily subject himself to a prosecution or a civil action; and he is not likely to be spared the disgrace and mortification attendant upon either, should it happen that the case is of a doubtful nature. The law expressly requires from each medical man a separate visit, a separate personal examination of the alleged lunatic, and a separate medical certificate, setting forth the *special fact or facts* (whether observed by himself or derived from the information of others) upon which his opinion is based. Conolly has shown that there are objections to the severity of the restrictions regarding these certificates ('Jour. of Med. Sci.,' 1861, p. 127), but several recent cases have proved that they are not even strong enough to prevent sane persons from being wrongfully sent as lunatics to asylums.

Specification of Facts.—It will be observed that every medical practitioner signing a certificate of insanity is required to specify the *facts upon which his opinion is formed*, and whether such facts are derived *from his own observation* or from the information of any other person. Medical men have had some difficulty in performing this duty; *i.e.* in assigning the fact or facts upon which their judgment of the insanity of a person was based. ('Lond. Med. Gaz.,' vol. xxxvi. p. 1434; and vol. xxxvii. p. 485.) What will constitute the description of a fact to render a certificate valid? This important question was raised in the case of *Shuttleworth.* (Queen's Bench, Nov. 1847.) An application was made for the discharge of a lunatic on the ground that the medical certificates did not set forth the *facts* from which the opinion of those who signed them was derived. In one, the medical man stated that the lunatic laboured under a *variety of delusions*, and that she was *dirty and indecent in the extreme;* in the other, the certifier stated that he had formed his opinion from the *conversation* which he had that day had with her. It was contended that the statement in the first certificate was not so much a fact as a conclusion drawn from other facts, which ought to have been mentioned in the certificate itself. Lord Denman, in giving the judgment of the court, held that the certificates were valid—that it was not necessary to have all the delusions of an insane person stated in a certificate. The statement that the lunatic was dirty and indecent in the extreme, was *primâ facie* sufficient to justify the imputation of insanity, even if the certificate did not state that the patient laboured under a variety of delusions. The allegation that the opinion respecting the existence of insanity was founded upon a *conversation* with the alleged lunatic, was also sufficient to render a certificate valid. ('Lond. Med. Gaz.,' vol. xxviii. p. 932; also 'Law Times,' Nov. 1846, p. 145.) They, therefore, refused to allow the discharge of the lunatic. This judgment was given by Lord Denman, and was concurred in by those eminent judges—Erle, J., Wightman, J., and Coleridge, J. Patteson, J., dissented to this extent: he thought a *conversation* had with the lunatic could not be received as the statement of a 'fact.' The judgment might have been formed upon many sufficient facts, but the surgeon had not condescended to state what those facts were.

This question of the sufficiency of 'a conversation to constitute a "fact"' in drawing up a medical certificate was raised in a case where Batteson, having duly examined an alleged lunatic, stated in his certificate as a 'fact' indicative of her insanity, 'from the conversation I have had with her,' following the decision in Shuttleworth's case, and using the same language. He quoted a former edition of this work as his authority, but the Commissioners in Lunacy refused to admit this case as a precedent, and required that some fact or facts, apart from mere conversation, should be distinctly stated. The Lunacy Acts Amendment Act (25 & 26 Vict., c. 3, 1862, section 37) confers a power on the Commissioners to deal according to their own judgment with medical certificates, and to set aside the judicial decision given in Shuttleworth's case. Thus it is enacted under this statute that 'Where any medical certificate upon which a patient has been received into any asylum, registered hospital, licensed or other house, or either of such certificates, is deemed by the Commissioners incorrect or defective, and the same are or is not duly amended to their satisfaction within fourteen days after the reception (by the superintendent or proprietor of such asylum, registered hospital, or licensed or other house) of a direction in writing from the Commissioners requiring amendment of the same, the Commissioners or any two of them may, if they see fit, make an order for the patient's discharge.' It would therefore appear that, in order to satisfy the Commissioners, a medical man must state some 'fact,' *i.e.* some act or deed on the part of the alleged lunatic, on which his opinion is based. The Court of Queen's Bench regarded a certificate based on 'conversation' only, as a substantial although not a literal compliance with the terms of the Act. Lord Denman thought that it would be monstrous to have all the delusions stated upon the document. Many of them were indecent, and many blasphemous. In spite of this reasonable objection to entering into the details of a 'conversation,' it is now clear that nothing less than this will satisfy the Commissioners in Lunacy. A medical man, therefore, in drawing up a certificate, should insert those parts of the conversation on which he relies, as well as a statement of any fact or facts in reference to habits or demeanour which, in his judgment, may indicate unsoundness of mind. 'Facts indicating insanity observed by myself,' are little appreciated or even understood by many medical men, who are legally empowered as registered members of the profession to sign these certificates. The facts are frequently stated in a loose and careless manner, showing a complete misapprehension of their meaning. What is really required by the law is a statement of facts observed or witnessed by the medical man himself, which would carry conviction to the mind of any non-professional man reading it, that the person to whom the statement referred was of unsound mind. A medical man should in all cases avoid giving as a fact indicating insanity, any delusion which might in reality have some foundation in truth.

With respect to the second requirement of the statute—namely, 'Other facts (if any) indicating insanity, communicated by others'—it may be observed that, although these do not supersede the facts observed by the medical man himself, they are of great importance in throwing light upon the propensities or habits of the patient, and thus serve as a guide for treatment. A medical man must take care to draw a clear distinction between the facts observed by himself and the facts communicated to him by others, and avoid such vague expressions as that he 'thinks' and 'believes,' &c.

As every medical certificate, although accepted by the Commissioners in Lunacy, may become at a future time a subject of close and hostile criticism in a court of law, a medical practitioner should be fully prepared to justify the use of the terms which he has employed. It is therefore desirable that he should studiously avoid any misstatement or exaggeration of the symptoms. One of the facts cited as indicative of insanity in an old lady was that she kept a cockatoo. In the case of *Davies*, Lord Brougham elicited from one of the witnesses, as a fact upon which he relied to indicate insanity, that, when asked the question, the alleged lunatic did not know how much money he had in his pocket. Another relied upon the fact as indicative of a weak mind, that he said he preferred seeing the people returning from Epsom races rather than the racing on the course. Vague and trivial facts, which do not indicate insanity, naturally tend to produce a feeling in the minds of a jury the very reverse of that for which they are brought forward. Thus in this case, although there could be no doubt, from what subsequently occurred, that Mr. Davies was a lunatic and a fit and proper person to be placed under restraint, yet the result of a skilful cross-examination in bringing into prominence the weakness of the facts on which the medical witnesses relied to establish insanity, had such an influence with the jury that they returned a verdict in favour of the lunatic, and for a time he was considered as the unhappy victim of an unjust persecution on the part of his relatives. A medical man, certifying to the insanity of a gentleman who was at that time undoubtedly insane, had stated, as facts *observed by himself*, that 'his (the patient's) habits were intemperate, and that he had squandered his property in mining speculations.' But on cross-examination, he was obliged to confess that the only act of intemperance he had actually observed was the patient's drinking one glass of beer, and that the squandering of property was the loss of what was to him a mere trifle in a mining speculation, which eventually turned out to be a very good one. (Millar's 'Hints on Insanity,' 1861, p. 187.) Counsel properly hold a medical practitioner strictly to the common and accepted meaning of the words which he uses. If strong points are not forthcoming, the proof of insanity must fail. Weak points generally show a weak case, and should never be brought forward or employed by a prudent witness.

A medical man is not compelled to take upon himself the responsible duty of signing certificates of insanity; but if he does undertake it, he must perform it with reasonable care and ordinary skill. If he certifies that a person is labouring under delusions, he must take care that he understands the meaning of the term, and what are the delusions; and admitting that he is correct in believing from his own observation that they exist in the mind of the patient, it must be remembered that, in order to justify restraint or imprisonment in an asylum, the law looks always to the immediate influence of these delusions upon conduct. In reference to medical responsibility, the following observations were made by a judge in the case of *Hall* v. *Semple* (Q. B., Dec. 1862): 'The true ground of complaint is the negligence of the defendant and the want of due care in the discharge of the duty thrown upon him; and I think that if a person assumes the duty of a medical man under this statute, and signs a certificate of insanity which is untrue, without making the proper examination or inquiries which the circumstances of the case would require from a medical man using proper care and skill in such a matter,—if he states that which is untrue and damage ensues to the party thereby, he is liable to an action, and it is to that I desire to direct your particular attention. In point of law, if a medical man assumes under this statute the duty of signing a certificate, without making that due and proper examination which under such circumstances he ought to make, not in the exercise of the extremest possible care, but of ordinary care, so that he is guilty of culpable negligence and damage ensue, then an action will lie against him, although there may have been no improper motive, and the certificate may not be false to his knowledge.' In this case the jury found a verdict for the plaintiff—that the certificate was untrue in effect, and that it had been signed without proper examination and inquiries and without probable cause. This, and the recent actions of Mrs. Weldon against Semple and Winslow, convey a severe caution to members of the medical profession; and also these latter actions convey the further caution that a medical man should not sign a certificate at the request of the proprietor or superintendent of the asylum into which the supposed lunatic is to be admitted, nor receive a fee of unusual amount for signing a certificate.

The Lord Chancellor's Lunacy Acts Amendment Bill and Lunacy Acts Consolidation Bill (1886) are now (March, 1886) before Parliament. The Amendment Bill is prefaced by the following memorandum:—

The principal objects of the Lunacy Acts Amendment Bill are: I. To furnish safeguards against the improper confinement of persons as lunatics. II. To put a stop to the system of single patients, except in the case of lunatics so found by inquisition, and to prevent the establishment of any new licensed houses. III. To give facilities for the medical treatment of persons who desire to submit to treatment and of idiot and imbecile children. IV. To enable public asylums to be provided for the reception of lunatics not paupers. V. To give increased powers to the court for administering the property of lunatics. VI. To make certain amendments in detail, with a view to a consolidation of the Lunacy Acts.

The Bill adopts in the main the recommendations made by the Report of the Select Committee on Lunacy Law in the year 1878.

I. The Bill provides (section 2) for the appointment of special justices to make orders for the reception of lunatics not paupers, and (section 3), except in cases of urgency, a person not a pauper is not to be confined as a lunatic without an order of a county court judge, stipendiary magistrate, or justice, to be obtained upon a petition presented, if possible, by a relative and accompanied by two medical certificates. Provision is made to secure privacy, and in order to give the county court judge, magistrate, or justice something more than 'merely ministerial' functions in cases which require investigation, he is empowered, if he considers the statements in the medical certificates unsatisfactory, to make inquiries, and, if he thinks it necessary, to visit the alleged lunatic. In urgent cases (section 4), a patient may be confined upon an order by a relative, accompanied by one medical certificate; but in that case a petition for an order must be presented to a county court judge, stipendiary magistrate, or justice within seven days, and the urgency order remains valid only for the seven days or so long as the petition is pending. Sections 6, 7, and 8 are intended to secure that the medical certificate shall be signed by disinterested persons. The power of an 'officiating clergyman' and overseer to confine a pauper patient is taken away (section 10), and provision is made to prevent the improper confinement of lunatics in workhouses (section 13). A report upon every private patient (section 21) is to be sent to the Commissioners in Lunacy within a month after the patient's reception as a lunatic, and a visit is to be made to the patient as soon as possible. If the patient is found to be improperly detained, he is to be discharged. Patients in hospitals and licensed houses beyond the immediate jurisdiction of the Commissioners are to be visited by the medical visitor appointed for the county or borough, and provision is made for his remuneration (sections 44) (3), (4). At the end of three years after the reception of a patient, and at the end of every subsequent year, a special report is to be made on his case (section 22). If no report is made, the order for his detention comes to an end. If the report is not satisfactory, the patient is to be visited, and, if it is thought proper, discharged. Any person may apply to the Commissioners for authority to have a patient medically examined with a view to his discharge if his detention should prove improper (section 30). Encouragement is given to the relatives of a pauper lunatic to take charge of the lunatic by allowing the visitors of the asylum to pay for the lunatic's maintenance while under the care of his relatives (section 32). Power is given to the Commissioners to make inquiries as to persons who are treated as lunatics in charitable and religious establishments and in the houses of persons who derive no profit from the charge (section 33).

II. After the passing of the Act, no order is to be made for the reception of a lunatic as a single patient unless he is a lunatic so found by inquisition (section 26) (1). The powers of the Commissioners over single patients (sections 26, 27) and their powers of discharge and removal are enlarged (sections 23, 24). No new licence is to be granted for a house for the reception of lunatics (section 43).

III. Persons who, though not of unsound mind, are desirous of submitting to medical treatment may be received as boarders in hospitals and licensed houses (section 31). Institutions for the training of idiot and imbecile infants are recognized and exempted, under proper safeguards, from the general law as to lunatics (section 34).

IV. Persons not paupers may be received in county and borough asylums upon special terms, and the justices of counties and boroughs are authorized to provide accommodation for lunatics not being paupers, either by enlarging existing asylums or by establishing new asylums (sections 56, 57, 58). Justices are also empowered to purchase licensed houses (section 58) (2). Powers are conferred upon the Secretary of State to enforce proper provision being made in counties and boroughs for the accommodation of lunatics, including lunatics not paupers (sections 60, 61).

V. Power is given to the court to appoint a committee of the estate only of a person who, upon inquisition, is found capable of managing himself, but incapable of managing his affairs (section 40). Although under the existing law a person may be deprived of his personal liberty upon an order signed by a relation and two medical certificates, there is no power (except in special cases) to protect and administer his property without the expensive procedure of an inquisition. This is amended by giving power to the Judge in Lunacy to exercise all the powers over the property of a person confined under order and certificates or incapacitated by age and infirmity, which he could exercise upon inquisition found (section 41).

Discharge of Lunatics.—In forming an opinion relative to the propriety of discharging a person who has once been confined as a lunatic in an asylum, it is proper to examine the particulars of his case with the same caution as if the object were to confine him for the first time. Experience shows, in reference to the criminal lunatics confined under State supervision, that there are strong reasons for their detention. In 1877, two men were readmitted, after their discharge as cured, on account of their having repeated the offences of which they had been previously convicted. The question of liberation is commonly restricted, like that of restraint, to cases of mania and monomania. It may so happen that the person has a lucid interval at the time of examination, in which case it will be necessary to make more than one visit. One who has been guilty of a heinous crime like murder should never on any pretence be discharged. There are often long lucid intervals in homicidal mania, and it is impossible to be certain that the disease is entirely removed. Instances have occurred in which persons who had been confined on account of acts of murder, and liberated on apparent recovery, have soon after their liberation murdered a wife or child, and have been again tried and sent to an asylum. Yet it appears to be the custom at Broadmoor to discharge, on their apparent recovery, patients who have been guilty of murder. In 1877, one man and three women, who had committed murder, were discharged and sent to their friends. The man had killed his son, and the women their children. They had been acquitted on the ground of insanity, and had apparently recovered.

A quiet and orderly manner maintained for many weeks or months may suffice to throw both physician and attendant off their guard. Orange relates a case in which a man was tried and convicted of murder in 1868. He became insane and was admitted into Broadmoor in 1869. For eighteen months he conducted himself with such propriety that he was allowed to go for walks with his attendant. One day, while thus walking, apparently quite restored, he asked his attendant a question about some rabbit-burrows near the path. The attendant stooped down to examine one of them, when, in an instant, he was felled to the ground by a heavy blow on the back of his head. The lunatic then attempted to strangle him, and ultimately escaped.

If the lunatic has manifested the least disposition to suicide, we should be extremely cautious in liberating him; for suicidal mania is often artfully concealed under a cheerful exterior. We cannot always test the propriety of granting liberation by the lightness of the offence for which a criminal lunatic has been confined. The circumstances under which the most trifling offence has been committed may show that the mind is wholly unsettled with regard to moral responsibility; and such lunatics can never be trusted, even when there is a great improvement in their language and deportment. In this respect, the case of *Dodwell* (C. C. C., March, 1878) is of some interest. This man discharged a pistol, in open court, at the Master of the Rolls. The motive which he assigned for the act was to draw attention to his case (a Chancery suit), and to have it brought fully before the public. He was tried for the offence, and acquitted by the jury on the ground of insanity. The result was that he was consigned as a lunatic to the Criminal Asylum at Broadmoor. The court and jury thought that the act of the accused showed a total absence of self-control, and that the motive assigned was irrational, and not consistent with soundness of mind. It was not considered necessary at the trial to require medical evidence of the state of mind of the prisoner. Like all lunatics, he strongly denied that he was insane. Soon after his acquittal and confinement in Broadmoor, Dodwell was seen on the part of his friends by two physicians. Their opinion was that he was quite sane and ought to be discharged; in fact, that he was a sane man, 'incarcerated in a living tomb.' The interests of the public do not appear to have been represented on this occasion. The prisoner was subsequently visited and examined by two other physicians, under an order from the Secretary of State, and three months afterwards by two independent medical men appointed by the Commissioners in Lunacy. The result of their interviews with the reverend gentleman was that he was considered to be decidedly insane, and that it would be unsafe to allow him to leave the prison.

The 16 & 17 Vict., c. 97, has placed certain restrictions on the power of liberating lunatics. Under ss. 83 and 84, the person originally signing the order which is required in addition to the medical certificates, may write an order for discharge or removal; but under s. 85 this order is of no effect, if a medical practitioner certify that, in his opinion, such patient is dangerous and unfit to be at large, together with the grounds on which his opinion is founded, unless the Commissioners or Visitors shall, after the production of such certificate, give their consent in writing for the removal or discharge of such patient. Under other clauses, additional powers of discharge are given to the Commissioners and Visitors, subject to such restrictions as to leave the control for the most part in the hands of professional men. These powers of discharge do not, however, apply either to criminal lunatics or to those found insane under a Commission of Lunacy.

Nullity of Marriage on Account of Lunacy.—It will be readily seen that the sexual perversion inseparable from various forms of insanity may lead to a union perhaps with some one far beneath the patient, and the influence of nymphomania leads to impulsive acts, which the person, who perhaps is an hysterical girl, does not stop to consider. The celebrated English case of *Miss Bagster* is an example of this kind. Miss Bagster was proved by the evidence to be a frivolous and weak-minded girl, whose education had been much neglected. She was a lady of fortune, and she ran away with, and was married to, a Mr. Newton. An application was made by her family to dissolve the marriage on the ground that she was of unsound mind. Amongst other facts urged before the Commission as a proof of the allegation, it was mentioned that she was occasionally violent and self-willed, that she was passionate as a child, and that even in maturer years she had little or no self-control; that she was ignorant of arithmetic, and therefore incapable of taking care of her property; that she had some erotic tendencies, which were evinced by her want of womanly delicacy and by her having engaged herself with a view to marriage to several individuals. On her examination before the Commissioners, her answers were intelligent, and her conduct in no way different from that of ordinary individuals. Seven medical witnesses were summoned to support the Commission, and each of them deposed that she was of unsound mind. The Commissioners, however, had recourse to Morrison and Haslam, who visited her, and who came to the conclusion that she was neither imbecile nor idiotic, and that her inability to manage her affairs arose from ignorance. She was aware of her deficiencies, deplored her ignorance of arithmetic, and explained it on the ground that her grandfather had been too ready to send excuses for idleness when she was at school. Her conversation greatly impressed Haslam and Morrison with a belief in her sanity. The jury, by a majority of twenty to two, returned a verdict that Miss Bagster had been of unsound mind since November, 1830, and that the marriage was consequently dissolved.

In the celebrated Durham divorce suit for nullity (*Durham* v. *Durham*, otherwise *Milner*, Divorce Ct., Feb., 1885), the plaintiff, the Earl of Durham, failed to obtain a dissolution of marriage with Miss Ethel Milner on the ground of insanity; it not having been proved to the satisfaction of the judge that Lady Durham was insane on the date of her marriage. A similar suit (*Cannon* v. *Cannon*) heard about the same time, the parties to it occupying a humbler station in life, also failed, though here the wife was clearly insane a few days subsequent to the marriage.

In *Hunter* v. *Hunter*, otherwise *Edney*, the marriage was dissolved on the ground that the bride was insane at the time of her marriage, and incapable of understanding the contract. (See Medico-Leg. Jour., iii. p. 71.)

CHAPTER 64.

LUNATICS AS WITNESSES.—INTERDICTION.—COMMISSIONS IN LUNACY.—EXAMINATION OF ALLEGED LUNATICS.—MEDICAL AND LEGAL TESTS OF COMPETENCY.—CONFLICT OF EVIDENCE AND OPINION.

Lunatics as Witnesses.—In regard to the testimonial capacity of lunatics, it may now be considered as settled that a lunatic who labours under delusions, but who in the judgment of a medical practitioner is capable of giving a fair account of any transaction that happened before his eyes, and who appears to understand the obligation of an oath, may be called as a witness. (*Reg.* v. *Hill*, 'Denison's Crown

Cases,' 2, p. 254.) The rule first laid down by Parke, B., is in accordance with this view: it is for the judge to say whether the evidence of the witness is admissible, and then his credibility is a question for the jury.

Lunatics occasionally bring actions for damages, involving charges of assault against those in whose establishments they may have been confined. A trial (*Nunn* v. *Hemming*, Exch. Div., Feb. 1879) shows how such cases are dealt with, and proves that, unless the testimony of a lunatic is corroborated, it will not be accepted by a jury. The plaintiff claimed damages from the defendant, for an assault while under his care as a lunatic patient. He had made an attempt to escape, was brought back to the asylum, and was, according to his statement, violently plunged into a cold bath and nearly drowned. No complaint was made of this treatment by him to the Commissioners until three years after the occurrence. In letters to his wife shortly after the alleged maltreatment, he had not mentioned it. The story of the plaintiff was directly contradicted by every living man who could have witnessed the scene if it had occurred, and there was no confirmatory or corroborative evidence. On the other hand, seven medical men had testified that the plaintiff at this time and subsequently had laboured under delusions, and had attempted suicide. The plaintiff admitted in court that he had swallowed his three shirt-studs, because he thought that, being gold, they would cure a pain in the stomach. His counsel contended that his statement was to be believed, and those who testified against him he treated as perjured witnesses. His contention was, 'Get rid of the plaintiff's delusion, and the facts are proved;' but this was precisely what could not be done, and the jury returned a verdict for the defendant. Any other conclusion would have been against justice and common sense. This case shows that the uncorroborated testimony of a lunatic labouring under insane delusions, will not be accepted as evidence.

Interdiction.—By interdiction we are to understand the depriving of a person labouring under mental disorder of his civil rights; in other words, preventing him from exercising any control or management over his affairs. It may be with or without restraint or confinement in an asylum, for one condition does not necessarily imply the other, although there is a popular idea to the contrary. In *Re Smith* (June, 1862), an order for a jury was issued to try the question of sanity or insanity, and in affirming the order, Knight Bruce, L.J., made the following statement: 'It is desirable to remove the idea, but too generally entertained by persons in different stations of life, that the finding by a jury that a person is of unsound mind necessarily involves an interference with his personal freedom: it does not. The court places no further restraint upon a lunatic than is necessary for his protection, and I would refer to the fact that there are several lunatics living under the protection of the court, who reside in their own houses with large establishments.'

When a person, from mental incompetency, is liable to be imposed upon by others, or is guilty of foolish and extravagant acts, whereby his property is wasted, a Commission is commonly granted by the

Court of Chancery, in order to determine whether he be '*compos*' or '*non compos mentis.*' This writ is well known under the name of '*de lunatico inquirendo.*' Before it can be issued it is necessary, among other matters, that there should be affidavits made by two physicians or surgeons, certifying to the insanity of the person. It has been already explained that the object of the Commission is to determine whether the incapacity to manage affairs is owing to some *mental* defect or disorder, and not merely to want of education or bodily infirmity—otherwise all wealthy minors and infirm persons might be deprived of the control of their property. Formerly Commissions were not issued unless it was evident that lunacy or idiocy existed—for weakness of mind or imbecility was not considered sufficient to justify legal interference. This is no longer the case, 'unsoundness of mind with incompetency' being all that the law requires to be established. Thus, then, whether the case be one of mania or dementia is not now the question, but whether the party be *compos* or *non compos mentis:* if the latter, whether it be to a degree to prevent him from controlling his property with careful and provident management. Some years ago, a person who had a delusion on a particular subject, although not affecting his social duties, was deemed a fit subject for a Commission, and deprived of his civil rights merely because his mental disorder would fall under the definition of lunacy. On the other hand, one who had no delusion, but great mental weakness, such as to incapacitate him for properly managing his affairs, was not deemed a fit subject for a Commission; since weakness of mind and insanity were considered to be two entirely different states—the latter alone requiring interference, although the injurious results might be the same in both cases.

These Commissions have been usually conducted on so expensive a scale as to render them applicable only to the wealthy classes of society; and even here the expenses attending such a simple inquiry as that for which the Commission is issued have been often of the most ruinous kind, and the results by no means satisfactory. The Lord Chancellor has it now in his power to direct an inquiry to be made before one or two Commissioners, in which case a jury is dispensed with. Evidence may then be received, and the decision left with the Commissioner or Commissioners so appointed. The costs of an inquiry by this regulation are greatly reduced; but even under the amended law, no Commission in Lunacy can be had at a less expense than 60*l.*, and this only in uncontested cases. This form of proceeding is now adopted in the greater number of cases, so that out of 575 Commissions in ten years only 21 were before juries. The Lunacy Regulation Acts are the 16 & 17 Vict., c. 70 (1853), and the 25 & 26 Vict., c. 86 (1862). The last-mentioned Act has greatly improved proceedings in lunacy, and has removed much of the injustice which formerly prevailed. In order to shorten these inquiries and lessen the expenses, the order under s. 3 is to be confined to the question whether or not the person is 'at the time of unsound mind and incapable of managing himself and his affairs.' No evidence on his conduct is to be received as a proof of insanity unless it refers to a period within *two* *years* of the date of the inquiry. In cases of contested imbecility, this provision might exclude important evidence, but there is a discretionary power in the judge to admit it. Section 4 allows of a case being tried by a jury at common law. The alleged lunatic is to be examined before the taking of the evidence, as well as at the close of the proceedings before the jury consult on their verdict. Under s. 12, power is given to the Chancellor to dispense with Commissions in reference to persons who have but small property, and there are in this statute other strict rules regarding the visiting of lunatics confined in asylums. In the case of *Mrs. Cumming* ('Jour. Psych. Med.,' April, 1852), a large portion of this lady's property was spent in determining by a verdict that she was insane; and there was an intention that the remainder should be expended in reversing the decision, when the unfortunate lady died.

One remedy for this serious evil would be that medical experts on such occasions should be selected and appointed by the Lord Chancellor, to examine an alleged lunatic, and give evidence on his condition; they should be in all cases made perfectly independent of both parties. At present they rather occupy the position of medical counsel than medical witnesses, for it is quite clear that no one would be summoned whose views did not coincide with those of the party summoning him. There are some medical men who appear to think that on these occasions they are justified in sinking the witness in the advocate, and that they are bound by a sort of duty to make the best of the case for the person who retains them; but this is a mistaken view of their position. A scientific witness is placed under a sacred obligation to state 'the truth, the whole truth, and nothing but the truth;' and it is a duty which he owes to his profession and to society that he should lay aside all personal bias. The confidence of the public in medical opinions in reference to the insane has been by recent events much shaken; and it would be altogether destroyed, and such opinions entirely dispensed with, if it were once known that a medical man on these occasions accepted a retaining fee not to speak the whole truth, but, rightly or wrongly, to give his evidence in favour of the party who consulted him.

Examination of Alleged Lunatics.—To determine whether a person is or is not a fit subject for interdiction or deprivation of civil rights, it is necessary to bear in mind that it is not enough to show that there is *delusion*, as in the lighter cases of monomania; but we are bound to ascertain how far the delusion affects the judgment of the person, so as to prevent him, like other men, from managing his affairs with provident care and propriety. In many instances, however, some proof of *delusion* only is sought for; and, if this be procured, it is hastily inferred that the person must be entirely incompetent to manage his property. The most difficult cases are those which involve questions of imbecility. In conducting the defence of the *Windham* case (Dec. 1861), Cairns was allowed by his medical advisers to make the following strange statement: 'In a case of insanity accompanied by delusions, the mode of investigating it so as to arrive at the truth is a matter of great difficulty and doubt; but in a case of imbecility, where there is either no mind at all or next to none, the task of coming to a right and just decision is comparatively easy.' Such a statement is the reverse of the truth, and must have been made under some hazy notion that the state of imbecility was identical with that of idiocy. One of his own witnesses (Sutherland), in a subsequent stage of the proceedings, corrected this error, by the admission, in cross-examination, that 'drawing the line between soundness and unsoundness of mind in cases of imbecility is one of the most difficult questions of medical science.'

In conducting the examination of an alleged lunatic, we should compare his mind as it is with what it is proved to have been; and if it be a case of supposed imbecility, a proper regard must be had to age, society, education, and general conduct. We should also consider whether the person has been treated by his friends and relations as a lunatic or imbecile prior to the issuing of the Commission. A young person whose education has been much neglected, and who has never been entrusted with the care of money, cannot be expected to have much knowledge of the method of managing a large property. Questions are sometimes put on the moral responsibility of man and the attributes of God, to one who, perhaps, never heard of ethics or metaphysics. Again, mathematical and arithmetical questions, which would embarrass many persons who are sane and competent, are sometimes put on these occasions. In one instance, a physician gave evidence on a Commission that he found the alleged imbecile could not work the first proposition in Euclid; but this person admitted that he had always disliked mathematics. In another case, one examiner asked the alleged imbecile, who said he had 1200*l.* in the bank, and received 20*l.* for interest,—How much was that per cent.? He said he could not tell: he was no good hand at arithmetic. The counsel who appeared against the Commission afterwards put the same arithmetical question to one of the medical witnesses who had deposed to the imbecility of the party; and this witness, an educated man, confessed himself quite unable to answer it—a practical illustration of the impropriety of pronouncing a person to be imbecile or incompetent merely because he is ignorant of that which he has never been taught. (Case of *David Yoolow.*) Unless the questions are confined to those subjects which the person has had either the opportunity or inclination to learn, a medical witness will always incur the risk of confounding mere ignorance with imbecility.

One of the best tests of mental capacity will be found in determining the degree to which, with ordinary opportunities, a person has shown himself capable of being instructed; but too high a standard must not be assumed as a test of capacity. The mind of an alleged imbecile should not be compared with the most perfect mind, but with that of another person of average capacity, of the same age and station in society, and who has enjoyed like opportunities of instruction. It would be difficult to find two sane persons who were exactly equal in mental power: in some, one faculty is prominently developed; in others, another. All that we have to look for in these cases of alleged unsoundness is an average degree of intellectual development, so as to qualify the person for performing the duties of his station. To win the confidence of an alleged lunatic for the purpose of examination, we should not treat his observations or delusions with levity, but rather seriously sympathize with him in his troubles; we should listen attentively to all he has to say, for his suspicions will be excited by many questions being put to him. If we cannot agree with his conclusions, we should not contradict him abruptly, but endeavour to draw him out by asking for some corroborative evidence of his statements. Before visiting the patient, we should make ourselves thoroughly acquainted with every particular connected with his history and condition, and treat him as much like a sane person as possible. The insane are exceedingly suspicious, and quick to detect any deceit practised on them. They are also jealous of the intrusion of strangers, and, unless great tact is employed, will look upon a medical man as an enemy. The patient should be informed that his perceptions are merely the result of natural disease; it is useless to tell him that he is under a delusion when his perceptions, although sometimes exaggerated, are too real to be doubted.

The conflicting medical evidence given on Commissions in Lunacy is in great part to be ascribed to the fact that the whole of the mind of the person is not fairly examined. One physician tests one faculty; another, another; each has his own theory of insanity, and each his own standard of competency. The witnesses in support of the Commission do not go so much to test the actual state of mind of the person, as to discover what they deem proofs of insanity; those against the Commission take an opposite course—they look only for some proofs of soundness. It cannot, therefore, happen otherwise than that different conclusions should be drawn under such different modes of investigation. There is another point which requires attention in these cases. Persons labouring under a slight degree of imbecility are very soon irritated; they are easily persuaded that they are ill used and persecuted; and when they happen to be questioned by parties who are represented as their enemies, they lose their self-command, and are no longer able to answer questions which under their ordinary state of mind they would reply to with perfect accuracy. A defective memory must not be hastily set down as a proof of legal unsoundness. This is more or less the natural result of age. A man may not have a good memory, and yet have a mind sound enough for the management of his affairs. A defective memory in an aged person, taken alone, proves nothing.

A medical witness must not allow himself to be embarrassed by medical or legal definitions of insanity. The malady may not assume the form of lunacy or idiocy, in a strictly legal view—nor of mania, melancholia, dementia, or idiocy, in a strictly medical view; but still may be a case of *such mental disorder* as to create *an incapacity for managing affairs.* This is the point to which a medical examiner has to direct his attention. Cases of imbecility present the greatest difficulty, and create the greatest conflict of opinion among medical witnesses. Imbecility strictly implies a weak or feeble mind, and this term is properly applied to one who has an intellect below par or below the normal average. The vagueness of these terms shows how difficult it is to draw a clear distinction between legal sanity and that degree of mental weakness implied by imbecility which would justify interdiction. Insanity, in the common acceptation of the term, cannot be proved in these cases: there will be no evidence of delusion, and there may be such an amount of self-control as to enable a person to maintain a rational conversation. Memory, judgment, and other faculties, although weak, are still present in a greater or less degree; and from one or two interviews only, an examiner might be disposed to pronounce the person of sound mind and competent to manage his own affairs. There is a wide field for argument here; for it may be said with some truth in a defence, 'that the doctors cannot put their fingers on a single point indicative of insanity.' In short, each fact specified by them may be frittered away with the remark that every one must have known some person who had either a bad memory or a weak judgment; who squandered money, who wasted it on unworthy objects, who hoarded it and refused to pay just debts, or who lost it in foolish speculations, &c. All this may be true, and yet the person in question may be legally of unsound mind and properly interdicted. As Pagan justly remarks, there is a facility of disposition in an imbecile or weak-minded person, which lays him open to be imposed upon by the artful and designing; and our conclusion regarding his competency must therefore be the result of a just appreciation of his general knowledge of affairs, derived from an examination of *all* his faculties. We have to consider how far his imperfect mind would prevent him from attending to his own interests, not in a manner which would ensure their most profitable application, but in such a way as would prevent his affairs from being involved in ruin. His knowledge and understanding may be so imperfect that his property would necessarily run to waste under his unassisted control. When it is proved that there has been habitual submission to the dictation of others, either from a long habit of being controlled, from indifference, or fear—when a man has allowed himself to be disobeyed or neglected by his servants, and to be openly cheated by tradesmen—these circumstances furnish evidence of weakness of mind, and a justification of the opinion that there should be interdiction. On the other hand, if a person when left to himself has managed his affairs with reasonable care and propriety, and has acted independently of others, there can be no stronger proof of his legal competency.

The testamentary capacity of imbeciles may be tried by the same rules. A man who is of such an easy disposition as to be improperly influenced in the use of his property while living, may be equally influenced by fear or control to make an improper disposition of it by his will; but in this case the terms of the will, if drawn up by himself, will allow a fair judgment to be formed of the mental soundness of the testator. There is on these occasions a method of testing the state of mind which has been suggested by Conolly—namely, by inducing the patient to express his thoughts in writing, as in a letter addressed either to his physician or to some confidential friend. This plan would probably often succeed in showing the existence of a delusion, when an oral examination would wholly fail; the patient would not be led to suspect that he was being subjected to an examination for a hostile purpose. The current of his thoughts would be uninfluenced by the suspicion that the act of writing was to test the state of his mind; and as no man can long write in a connected manner who does not think collectedly, so we may expect to find ample evidence whether a delusion really exists in his mind or not. There are cases recorded in which the evidence of delusion has been derived from the terms of a will or deed written or dictated by the lunatic himself, when there was great difficulty in obtaining proof by an oral examination.

In idiocy there is no capacity for writing. In dementia, as there is no memory, it commonly happens that the same word is written over and over again. No person in a state of dementia can write a connected sentence, because, before the last part of the sentence is completed, the first is forgotten. In imbecility we may meet with every variety of mental defect, but the state of the mind is generally well shown by the expression of the thoughts in writing. This method, it must be remembered, cannot show whether or not a person is capable of managing his affairs; it is a mere index of a certain state of mind, and must be coupled with general habits and conduct, before any conclusion is drawn from it relative to the propriety of interdiction. It will often serve to detect the existence of a delusion when other means fail. Winslow attached some importance to handwriting as foreshadowing the occurrence of general paralysis with softening of the brain. This, however, refers not so much to composition or style as to correct writing and spelling. The reader will find a complete essay on the writings of the insane, and the medico-legal conclusions to which they lead, by Marcé, in the 'Ann. d'Hyg.,' 1864, t. 1, p. 379. When a verdict of insanity is returned under a Commission, it must always represent the person to be of unsound mind, and by reason of that unsoundness to be incompetent to manage his affairs. A date must be fixed at which the insanity first appeared, and this date should always be anterior to the issuing of the Commission. If there are lucid intervals, the space of time occupied by these should also be defined.

Among cases well calculated to show the conflict of medical evidence on Commissions in Lunacy, is that of *W. F. Windham* (Dec. 1861). Fifteen of the relatives of this gentleman petitioned for an inquiry into his state of mind, on the ground that he laboured under congenital deficiency of intellect (imbecility), and this view was supported by strong medical opinions; on the other side, it was alleged that the mental condition of Mr. Windham, if below the normal standard, was merely the result of a neglected education. The inquiry lasted thirty-three days, during which 140 witnesses were examined—namely, fifty on the part of the petitioners, and ninety in favour of Mr. Windham, at a cost of about 30,000*l*. There was no proof of the want of opportunity of education, but strong reason to believe that the alleged imbecile had not, like other boys of his age, made use of the advantages which he had enjoyed. He had been sent to Eton, but had derived little benefit there. It seems to have been admitted that, as a boy, he was wholly unlike other boys, and when he attained his majority, in Aug. 1861, his conduct was extravagant, wild, and quite inconsistent with his social position. At the same time, he was not entirely deficient in business matters; for it was proved that his uncle, one of the petitioners, had shortly before negotiated with him for the sale of a piece of land of the value of 1000*l.*, thereby admitting his capacity to transact business. The evidence received on this occasion was allowed to extend to the whole of his life; and it may be observed that in cases of alleged imbecility it is not possible, without doing injustice, to prevent the reception of evidence from a long antecedent date. The result of this inquiry was that the jury, by a majority of fifteen to eight, returned the following verdict: 'That Mr. Windham is of sound mind, and capable of taking care of himself and his affairs.' After the verdict had been returned pronouncing him sane and competent, he was guilty of many extravagant acts, exhausted a splendid fortune, and became a bankrupt; showing that, whatever legal soundness of mind he might possess, he practically did not evince the capacity of taking care of his affairs.

A large section of the public joined in the view prominently put forward at this inquiry by his counsel, that this unfortunate young man had been made the victim of a charge the most cruel, unjust, and unjustifiable. Insanity, it was urged, in the ordinary acceptation of the word, did not exist in his case. There were no illusions, hallucinations, or insane delusions; but as these are never met with in the form of unsoundness imputed to Mr. Windham, namely, imbecility, their absence proved nothing for or against the existence of imbecility or weakness of mind. But what test is there for imbecility except conduct and conversation? There was no incoherency of language, but there was strong evidence of habits such as we do not meet with among men of really reasonable minds; but opinions were divided on the question whether these indicated unsoundness of mind, or a mixture of eccentricity and moral depravity from deficient education. A majority of the jury took the latter view; and Lord Chelmsford, in commenting upon this verdict in the House of Lords, said, 'The law as laid down by Lord Lyndhurst applied to cases short of insanity, but they must be cases of unsoundness of mind; and mere extravagance or follies, which indicated imbecility, would not be sufficient unless the imbecility amounted to unsoundness of mind.' The legal test of the existence of this state of mind, we are told by high authority, is 'conduct.' A lawyer means by madness 'conduct of a certain character,' while a physician means by it 'a certain disease, one of the effects of which is to produce such conduct.' (Stephen's 'Crim. Law of England,' p. 87.) The whole evidence against Mr. Windham bore upon conduct, and from the verdict we learn what sort of conduct does *not* constitute unsoundness in a legal sense. Thus the marrying of a woman of disreputable character, the squandering upon her of 14,000*l.* in jewellery, and settling upon her, without any reasonable grounds, 800*l.* per annum, with other extravagant acts of a similar kind, do not constitute 'conduct of a certain character' sufficient to render a man *non compos mentis* in the eye of the law; but if these acts evince soundness of mind and a competency to manage affairs, what are the acts which indicate unsoundness or incompetency? On the other hand, we are told that the physician looks to the existence of a certain disease; but a physician can know nothing about the existence of disease of the brain during life in any case of imbecility, except in so far as its effects may be manifested by conduct. We therefore come round to the legal test of 'conduct,' which in Mr. Windham's case was considered to be quite consistent with the provident management of a large estate and a splendid fortune. That the legal test was here a failure in affording protection from wastefulness is proved by the result—the loss of the whole property from reckless extravagance.

So strong was the public feeling in reference to medical evidence after this inquiry, that the Lord Chancellor actually proposed to exclude it altogether in Commissions in Lunacy, except in so far as it was based on *facts* within the personal knowledge of the witnesses. It was suggested that the general scientific conclusions of experts should *not* be received as evidence. This proposition, which would have been most injurious to the interests of the insane as well as of the sane, did not meet with a favourable reception.

A Commission in Lunacy may be superseded, but the evidence must then be as strongly in favour of sanity as it was before in favour of insanity. The onus of proof is then thrown on the person who has been found lunatic.

CHAPTER 65.

CIVIL RESPONSIBILITY. — TESTAMENTARY CAPACITY. — WILLS MADE BY THE INSANE.—TEST OF CAPACITY.—EVIDENCE OF DELUSION.—ECCENTRICITY.

Testamentary Capacity. Wills made by the Insane.—Questions involving the testamentary capacity of persons are of frequent occurrence, and medical evidence is commonly required for their solution. When property is bequeathed by a testator out of the usual order of succession, it may be alleged by the relatives that he was incompetent to understand the nature of the deed—either from insanity, the imbecility of age, or that natural failing of the mind which is so often observed to occur from disease or on the approach of death. A *disposing* mind is what the law requires to render a will valid, and this does not rest so much upon the question of sanity or insanity, as upon the proof of competency or incompetency in the testator. The best test of capacity for this act is that a man, at the time of signing the will, should know the nature and amount of his property and the just claims of those who are nearly related to him. It has been truly said that the evidence of the medical attendant on the state of the testator's mind, at the time of the execution of the will, is worth more than the opinions of experts or of witnesses who may have seen the testator at other times and under other circumstances. ('Med. Times and Gaz.,' 1871, ii. p. 203.) A medical man is frequently of necessity a witness to a will, and he should always remember that, when he signs his name to it as a witness, he is practically testifying to the competency of the testator to make it.

Bodily disease or incapacity does not affect the validity of a will, unless the mind is directly or indirectly disturbed by it. A man's mind, under these circumstances, may not be so strong as in robust health, but still it may retain a disposing power. In *Harwood* v. *Baker* (Privy Counc., 1841), a will was pronounced to be invalid owing to the general state of bodily disease in which the testator was at the time of making it. He was labouring under erysipelas and fever, and these diseases had produced a degree of drowsiness and stupor which rendered him incompetent to the act. In the case of *Day* (1838), epilepsy was alleged to have affected the mind; and in the case of *Blewitt* (1833), paralysis was adduced as a ground of incompetency. In all cases of this kind, the law looks exclusively to the actual *effect* of the bodily disease upon the *mind* at the time the will was made; and this is commonly a question to be determined by a jury from the testimony of the usual medical attendant of the deceased, as well as from the evidence of medical experts.

Test of Capacity.—A person is considered to be of a sane and disposing mind who knows the nature of the act which he is performing, and is fully aware of its consequences. From some decisions that have been given, it would appear that a state of mind for which a person might be placed under interdiction or deprived of the management of his affairs, would not render him incompetent to the making of a will. The validity of the will of a lunatic was once allowed, although made while he was actually confined in an asylum, because the act was rational, and it was such as the lunatic had announced his intention of making, some years prior to the attack of insanity. (*Coghlan's* case; see *Re Garden*, 'Law Times,' July 6, 1844, p. 258; also the case of *Cartwright*, Mayo on 'Med. Test.,' p. 44.) In *Nichols and Freeman* v. *Binns* (Prob. Ct., Aug. 1858), the question was whether the will of a Mr. Parkinson, made in a lunatic asylum near Norwich, was executed during a lucid interval. The jury found a verdict in favour of the will. In *Parker* v. *Lord* (1876), the testator, Lord, a surgeon, was afflicted with insanity in Jan. 1875. It was proved that he had lucid intervals. He executed his will in the following February. The court pronounced for the will, in which there was a reasonable disposition of his property, on the ground that it had been executed during a lucid interval.

The insanity of a person, when not already found insane under a Commission, must not in these cases rest upon presumption or probability, but be established by positive proof. The act of suicide is often hastily assumed to be evidence of insanity; but it would not be allowed as a proof of this state, even when a testator had destroyed himself shortly after the execution of his will. A case has been decided where the testator committed suicide three days after having given instructions for his will; but the act was not admitted as a proof or even as a presumption of insanity at the time, and the will was pronounced to be valid. In another case, *Edwards* v. *Edwards* (Prerog. Ct., Feb. 1854), it was proved that the testator had committed suicide three days after the execution of his will, and there was some evidence of eccentric habits almost amounting to insanity; but the will was found valid. In *White* v. *Halford* (Prob. Ct., Feb. 1874), a will was contested on the ground that the testator had thrown himself out of his bedroom window, and had inflicted some severe injuries on himself a night or two before the will was made. He repeated these attempts on himself, and eventually died in a lunatic asylum. The jury found in favour of the will. There was no proof that the testator was labouring under any delusion when it was made. Suicide alone is not deemed to be such a proof of the existence of insanity as to render a will invalid.

Delusion in the Deed.—The validity of deeds executed by persons affected with monomania is often a subject of dispute. The practice of the law indicates that the mere existence of a delusion in the mind of a person does not necessarily vitiate a deed, unless the delusion form the groundwork of it, or unless the most decisive evidence be given that, at the time of executing the deed, the testator's mind was influenced by it. Strong evidence is often derivable from the act itself, especially when a testator has drawn up the will of his own accord. In the case of *Barton* (1840), the Ecclesiastical Court was chiefly guided in its decision by the nature of the instrument. The testator, it appeared, laboured under the delusion that he could dispose of his own property to himself, and make himself his own legatee and executor. This he had accordingly done. The will was pronounced to be invalid. But a will may be manifestly unjust to the surviving relatives of a testator, and it may display some of the extraordinary opinions of the individual: yet it will not necessarily be void, unless the testamentary dispositions clearly indicate that they have been made under the influence of *a delusion*, and, as has been already remarked, what relatives assert to be delusions are often actual facts. Some injustice may possibly be done by the rigorous adoption of this principle, since delusion may certainly enter into a man's act, whether civil or criminal, and it may not be always in our power to discover it; but, after all, this is perhaps the most equitable mode of construing the last wishes of the dead. The proof of the existence of delusion may be very close upon the date of the will, as in *Sewell* v. *Wells* (Prob. Ct., June, 1877), and yet the will may be held to be valid. The testator made his will on March 10, 1875. It was admitted on both sides that he was insane in May, 1875, and there was evidence that he was labouring under delusions regarding himself and his property on March 15, *i.e.* five days after the date of the will. The jury found that there was no-delusion when he made the will. Delusions may exist without being in all cases manifest or discoverable. Persons who have committed suicide, or who have destroyed their own property, or done any other act from which unsoundness of mind might be inferred, might be enabled to conceal the delusions under which they laboured down to the last moment of their lives.

According to Nichol, it is not necessary in civil suits to connect the morbid imagination with the act itself; if the mind is proved to be unsound, the act is void. In *Roberts* v. *Kerslake* (Warwick Aut. Ass., 1854), Lord Wensleydale held that, to vitiate a will, if it be a case of delirium, the act must be traced to delirious delusion, but, if it be a case of lunacy, it need not be traced to a delusion. In *Sharpe* v. *Macauley* (Winchester Aut. Ass., 1856), Martin, B., advised the jury, in coming to a conclusion on the question whether the testator had a 'sound and disposing mind,' to look, not to the opinions of others, but to the man's own acts as well as his correspondence. A disposing mind implied that a man understood the nature of his property, the use and benefits arising from it, and had sense and discretion to select persons to enjoy it after his death. A man may have laboured under delusions and have been confined as a lunatic, yet at the date of his will he may have been sane and have had a disposing power. The main question, therefore, is—Was the testator of sane mind when the will was executed? This may be deduced from direct evidence of his condition as well as from the provisions of the will itself.

Eccentricity in Wills.—The evidence in these cases sometimes amounts to proof of eccentricity only on the part of the testator, or in the deed itself; but a clear distinction must be here drawn. The will of an eccentric man is such as might always have been expected from him; the will of one labouring under insanity (delusion) is different from that which he would have made in an unaffected state—the instrument is wholly different from what it would once have been. The insane are eccentric in their ideas, their language, or their conduct; but the merely eccentric have but a voluntary resemblance to the insane in these respects. (Jamieson's Lect., 'Lond. Med. Gaz.,' vol. xlvi. p. 180.) They can if they please alter their conduct and act like other persons neither eccentric nor insane. In a case in the Probate Court, Hannen, J., observed that it was impossible to define exactly the distinction between eccentricity and insanity, or to draw the exact line between sanity and insanity, but for practical purposes we are able to say in a particular instance whether a man is sane or insane. The acts of eccentricity may be harmless, and the evidence may show that, up to the time of death, the testator may have been treated as a person of sound mind. In *Burdett* v. *Thompson* (Prob. Ct., July, 1873), the will of a testatrix was disputed because in a codicil she had ordered the doors and windows of her house to be bricked up, and the house locked up with the furniture and contents for a period of twenty years. Further, that her pony, pigeons, dogs, and poultry were to be shot after her death. It was proved that she was a shrewd and intelligent woman, and managed her own affairs down to the time of her death. On the other hand, it was contended that these acts were an indication of mental disease. Hannen, J., said it was impossible to lay down any abstract proposition as to what constituted unsoundness of mind. No person's mind could be said to be perfectly sound, just as no person's body could be said to be perfectly sound; but the question in these cases was whether there was such a degree of unsoundness as to interfere with those faculties which required to be brought into action in making a will. The jury were not able to agree upon this question, and were discharged.

Wills are sometimes contested more on the ground of eccentricity than of insane delusion; but if eccentricity only be proved, a court will not interfere. In the case of *Morgan* v. *Boys* (1838), it was proved that the testator, by his will, had left a large fortune to his housekeeper. The will was disputed on the ground that it bore intrinsic evidence of the deceased not having been in a sane state of mind at the time of making it. After having bequeathed his property to a stranger, the testator directed that his executors should 'cause some parts of his bowels to be converted into fiddle-strings, that others should be sublimed into smelling-salts, and that the remainder of his body should be vitrified into lenses for optical purposes.' He further added, in a letter attached to his will, 'The world may think this to be done in a spirit of singularity or whim; but I have a mortal aversion to funeral pomp, and I wish my body to be converted into purposes useful to mankind.' It was shown that the deceased had conducted his affairs with great shrewdness and ability; that he not only did not labour under imbecility, but that he had been always treated during life as a person of indisputable capacity by those with whom he had to deal. Jenner, in giving judgment, held that insanity was not proved: the facts merely amounted to *eccentricity*, and on this ground he pronounced for the validity of the will. The best rule to guide the court was the conduct of persons towards the deceased; and the acts of his relatives evinced no distrust of his sanity or capacity while he was living. The deceased had always been noted for his eccentric habits, and he had actually consulted a physician upon the possibility of his body being devoted to chemical experiments after death. In the case of *Mudway* v. *Croft* (Prerog. Ct., Aug. 1843), a will contested on the ground of insanity but defended on the plea of eccentricity, Fust said, 'It is the prolonged departure, without an adequate external cause, from the state of feeling and modes of thinking usual to the individual when in health, that is the true feature of disorder of the mind.'

Wills in Senile Dementia.—Wills made in incipient dementia arising from extreme age (senile imbecility), are often disputed, either on the ground of mental deficiency, or of the testator, owing to weakness of mind, having been subjected to control and influence on the part of interested persons. If a medical man be present when a will is executed, he may satisfy himself of the state of mind of a testator, by requiring him to repeat from memory the mode in which he has disposed of the bulk of his property. A medical man has sometimes placed himself in a serious position by becoming a witness to a will without first assuring himself of the actual mental condition of the person making it (case of the *Duchess of Manchester,* 1854). It would always be a good ground of justification if, at the request of the witness, the testator is made to repeat substantially the leading provisions of his will from memory. If a dying or sick person cannot do this without prompting or suggestion, there is reason to believe that he has not a sane and disposing mind. It has been observed on some occasions, when the mind has been weakened by disease or infirmity from age, that it has suddenly cleared up before death, and the person has unexpectedly shown a disposing capacity. ('Ann. d'Hyg.,' 1831, p. 360.) In *Durnell* v. *Corfield* (Prerog. Ct., July, 1844), a case in which an old man of weakened capacity had made a will in favour of his medical attendant, Lushington held that, to render it valid, there must be the clearest proof, not only of the *factum* of the instrument, but of the testator's knowledge of its contents. ('Law Times,' July 27, 1844.) In *West* v. *Sylvester* (Nov. 1864), Wilde, J., in pronouncing judgment against a will propounded as that of the deceased, an aged lady, said, 'At the time she executed the will, although for many purposes she might be said to be in her right senses, she was nevertheless suffering from that failure and decrepitude of memory which prevented her from having present to her mind the proper objects of her bounty, and selecting those whom she wished to partake of it.'

Wills in Extremis.—Wills made by persons whose capacity during life has been never doubted, while lying at the point of death or, as it is termed, *in extremis*, are justly regarded with suspicion, and may be set aside according to the medical circumstances proved. Many diseases, especially those which affect the brain or nervous system, directly or indirectly, are likely to produce a dulness or confusion of intellect, under which a proper disposing power is lost. Delirium sometimes precedes death, in which case a will executed by a dying person thus affected would be pronounced invalid.

In examining the capacity of a person under these circumstances, we should avoid putting leading questions—namely, those which suggest the answers 'yes' or 'no.' Thus, a dying man may hear a document read over, and affirm, in answer to such a question, that it is in accordance with his wishes, but without understanding his purport. This is not satisfactory evidence of his having a disposing mind: we should see that he is able to dictate the provisions of the document, and to repeat them substantially from memory when required. If he can do this accurately, there can be no doubt of his possessing complete testamentary capacity. But it may be objected that many dying men cannot be supposed capable of such an exertion of memory: the answer is then very simple; it is better that the person should die without a will, and his property be distributed according to the law of intestacy, than that, through any failing of his mind, he should unknowingly cut off the rights of those who have the strongest claims upon him.

Habitual Intemperance.—A man may be of drunken habits, and yet not incapacitated for making a will. In *Smith* v. *Austen* (Prob. Ct., Nov. 1875), Hannen, J., pronounced in favour of the will of a man who was proved to have been of exceedingly drunken habits. The question was whether his mental faculties had been thereby enfeebled so as to render him incapable of exercising his judgment. There was no proof of this, and during life he had not been treated by anybody as incapable of managing his affairs.

Effect of Narcotics.—The habitual use of opium or other narcotics may give rise to a question respecting testamentary capacity. We were consulted in a case of this kind, in which the testator had been in the habit of taking morphine, until, according to our informant, the dose had reached fifteen grains a day. He made a will fairly disposing of his property among his children. Nine days afterwards he made another will, entirely revoking the previous one, leaving his property to a younger son, who was alleged to have exerted an undue influence. The will was declared valid.

The long use of narcotics, in large doses, may weaken the powers of the mind, and render a man more easily amenable to improper influence; but the question will be in this case, as with drunkards, whether the habit has permanently enfeebled the mind so as to prevent a man from exercising a reasonable disposition of his property. The proof of this will rest with those who would benefit by the allegation.

Restriction of Medical Opinions.—In an important case (*Bainbrigge* v. *Bainbrigge*, Oxford Sum. Ass., 1850) tried before Lord Campbell, in which the testamentary capacity of a man was disputed, it was held that a medical witness, although conversant with cases of insanity, cannot be asked his opinion as to the insanity of a testator founded upon evidence given at the trial in his hearing. (4 Cox, 'Crim. Cases,' 454; see also on this subject, 'Lond. Med. Gaz.,' vol. xlvi. p. 240.) In the case of the *Duchess of Manchester*, however, the opinions of Sutherland, Mayo, and Conolly on the competency of the testatrix to make a will were received by the court, although based only upon evidence given at the trial. The above decision may, indeed, now be considered as entirely set aside.

CHAPTER 66.

THE PLEA OR DEFENCE OF INSANITY.—CIRCUMSTANCES UNDER WHICH IT IS ADMISSIBLE. — HOMICIDAL INSANITY.—MORAL INSANITY.—SYMPTOMS. — LEGAL TESTS.—MEDICAL TESTS.—DELUSION.—TESTS OF IRRESPONSIBILITY. —MEDICAL EVIDENCE.

The Plea or Defence of Insanity.—Responsibility here signifies nothing more than liability to punishment for crime, and a criminal act implies the existence of intention, will, and malice. (Stephen.) When insanity has reached a certain stage or degree, an act may be perpetrated without malice; and in this sense the person is considered to be irresponsible in law. This is a question of *fact*, to be determined by a jury from the whole evidence set before them; and the proof rests with those who make the allegation that the act in question, whether murder or arson, was not done wilfully and maliciously. 'The sanity of a man's conduct,' observes Stephen, J., 'involves the presence of intention and will on all ordinary occasions; and if the act is one of those which the law forbids, it is presumed to be malicious and wicked.' ('Crim. Law of England,' p. 89.) This subject is of considerable importance in a medico-legal view; for should a plea of insanity be improperly admitted in any criminal case, then punishment is made to fall unequally on offenders; and if, on the other hand, it be improperly rejected, punishment is administered with undue severity, and loses its deterrent influence. The rule of law is that no man is responsible like a sane person for any act committed by him while in a state of insanity; but the existence of mental disease does not necessarily exempt a person from criminal responsibility. (*Reg.* v. *Burton*, Maidstone Lent Ass., 1862.) Many a man whose mind is unsound knows perfectly well that he is doing wrong; and so long as he knows *that*, he is subject to the criminal law. The plea of insanity may be raised for the smallest offence up to the highest crime—murder; but it is rarely made a defence in smaller offences, because the confinement to which an accused person, if found insane, would necessarily be subjected, would often be a heavier punishment than that which the law actually prescribes for the offence which he may have committed. In a case of felonious assault, it was urged by counsel in defence, that the prisoner was insane; but the evidence on this point was not by any means conclusive—when it was intimated by the court that, if this plea were admitted, the party would probably undergo a much longer imprisonment than if on conviction he received the legal punishment for the offence. (*Reg.* v. *Reynolds*, Bodmin Aut. Ass., 1843.) The judge is reported to have said that there was no proof of insanity. If the prisoner was pronounced insane, he might be imprisoned for life, and therefore he did not think that *that* finding would benefit him. A verdict of guilty was returned, and the man was sentenced to eighteen months' imprisonment. This case shows that a defence of this kind may be sometimes indiscreetly put forward. Such a mode of dealing with the plea of insanity, *i.e.* of making it a question of expediency dependent on the amount of punishment for the offence, must be pronounced indefensible.

The discharge of persons who have perpetrated a criminal act or heinous crime, but have been acquitted on the ground of insanity and confined during her Majesty's pleasure, is a very serious matter, and one in which the safety of the public is deeply concerned. Some medical men appear to think that the interest of the prisoner alone is to be considered; but this would lead to the discharge of many dangerous lunatics. (*Dodwell's case, ante*, p. 752.)

Murder, incendiarism, and theft are the crimes for which the plea of insanity is commonly raised; and it has been generally confined in this country to those cases in which persons have been charged with murder or attempts at murder. Murder may be perpetrated by one who is obviously labouring under delirium or violent mania, or by an idiot or imbecile. Apart from the circumstances connected with the criminal act, there may be clear evidence of such a disordered state of mind in the person, as at once to exonerate him from that amount of responsibility which is exacted from one who is sane. The appearance of the accused, or the testimony of a medical man, renders it unnecessary to go into the evidence, and a verdict is returned accordingly. The cases of difficulty are those in which insanity presents itself in a doubtful aspect, as in mania complicated with epilepsy, or in some forms of imbecility. The mental disorder may be of so slight a nature as not to justify an acquittal for murder. In order to exculpate a person, it must be proved that insanity in a certain degree existed at the time of the perpetration of the act. Whether the prisoner is or is not insane when placed on his trial, is immaterial in reference to the question of responsibility. In the case of *Murray* (High Ct. of Just., Edin., Nov. 1858), it was proved that the accused recovered his sanity eight hours after he had killed the deceased; but he was acquitted on the ground of insanity at the time of committing the act.

The proved existence of mental disease does not necessarily exempt a person from criminal responsibility. Even the existence of a morbid delusion cannot always be allowed to screen a criminal from the consequences of his own acts; while, on the other hand, there are instances in which a plea of insanity may be properly allowed, although no delusion can be proved. Each case must be taken with all its surrounding circumstances.

The great difference of opinion which exists between physicians and jurists in reference to this plea appears to consist in this: most jurists contend that no degree of insanity should exempt from punishment for crime, unless it has reached that point *that the person is utterly unconscious of the difference between right and wrong at the time of* committing the alleged crime. Physicians, on the other hand, affirm that this is not a proper test of the existence of that degree of insanity which should exempt a man from punishment for his acts; that those who are labouring under confirmed insanity, and who have been properly confined in asylums for years, are fully conscious of the difference between right and wrong, and are quite able to appreciate the illegality as well as the consequences of their acts. Again, those who have patiently watched the insane for years agree that the legal test of utter unconsciousness of right and wrong in the performance of acts would in reality apply only to persons who were suffering from delirium, from furious paroxysms of mania, or from confirmed idiocy; and that if the rule suggested—that a person, in order to be acquitted on the ground of insanity, should be first proved to be as *unconscious* of his act *as a baby* (Warren)—were strictly carried out, there is scarcely a lunatic inmate of an asylum who destroyed a keeper or attendant, who might not be executed for murder. Such a rule amounts to a *reductio ad absurdum:* it would abolish all distinction between the sane and the insane, between the responsible and the irresponsible; and it would consign to the same punishment the confirmed lunatic and the sane criminal. This species of *baby-unconsciousness of action* exists in idiots as well as in furious maniacs, but not in the majority of lunatics; and it may be safely asserted that, if this criterion be the true one, acquittals on the ground of insanity have involved a series of gross mistakes for the last sixty years. It may be said that the consciousness of the insane is an insane consciousness, while the law implies the consciousness of a sound mind; but this involves a *petitio principii.* There have been numerous cases of acquittal in which, until the act of homicide had been committed, there was no imputation either against the sanity or the sane consciousness of the accused. Having pointed out these inconsistencies, we must acknowledge that in theory the English law would punish a lunatic just as it would punish a sane man, provided the lunatic 'had that degree of intellect which enabled him to know and distinguish between right and wrong, or between what was lawful and unlawful; if he knew what would be the effect of his crime, and consciously committed it; and further, if with that consciousness he wilfully and intentionally committed it.' In practice, however, it is placed beyond doubt that some who ought to be convicted under these rules are acquitted on the legal assumption that they were at the time unconscious (or only insanely conscious) of the wrongfulness of their acts. Wood states, that of thirty-three men confined as lunatics in Bethlehem who had committed murder, and who had been tried and acquitted on the ground of insanity, *three* were reported sane; and he was quite satisfied that two of these were *not insane* at the time they committed the murders. Of fifteen men who had attempted to commit murder, five were reported sane, and two of them, in his judgment, ought not to have been acquitted on the ground of insanity. ('Plea of Insanity,' p. 50.) According to Hood, in the six years from 1852 to 1858, 120 persons who were tried for murder, for attempts at murder, or acts of personal violence, were acquitted on the ground of insanity. Of that number, 79 were received into Bethlehem Hospital, and in several instances they exhibited no symptoms of insanity while they were resident in the asylum. These facts, then, are sufficient to show that the rule of law generally adopted, does not err on the side of severity. It operates, however, with great uncertainty. Some judges have admitted that there might be a consciousness that the act was wrong and illegal, and yet the person would be exempted from criminal responsibility, provided it was proved by other circumstances that he laboured at the time under a disease of the mind sufficient to prevent him from exercising a proper control over his actions.

When the defence of insanity is set up on a charge of murder,—in order to warrant the jury in acquitting a prisoner, it must be proved affirmatively that he was *insane in a certain legal sense at the time of perpetrating the act*; if this be left in doubt, and if the crime charged in the indictment be proved, it is their duty to convict him. (*Reg.* v. *Stokes*, 3 Car. and Kir., p. 185.) It is necessary to impress upon the mind of the medical witness, that it is not *medical* but *legal* insanity which is required to be proved on these occasions. As hardly two medical men agree about what is madness in a medical sense, and as some doctors have even held that all great criminals are necessarily insane, it is obvious that the power to absolve from responsibility could not at present be placed in the hands of the profession with a due regard to the protection of society or a safe administration of the law. The facts stated by Hood and Wood, in reference to the admission of alleged criminal lunatics into Bethlehem (p. 772), show that, either by legal or medical ingenuity, or both combined, sane criminals have been incarcerated as irresponsible lunatics.

Homicidal Insanity.—Homicidal mania is commonly defined to be a state of partial insanity, accompanied by an *impulse* to the perpetration of murder; hence it is sometimes called impulsive or paroxysmal mania. There may or may not be evidence of *intellectual* aberration, but the main feature of the disorder is the existence of a destructive impulse which, like an insane delusion, cannot be controlled by the patient. This impulse, thus dominating over all other feelings, leads a person to destroy those to whom he is most fondly attached, or any one who may be involved in his delusion. Sometimes the impulse is long felt, but concealed and restrained: there may be merely signs of depression and melancholy, sleeplessness, low spirits, and loss of appetite, as well as eccentric or wayward and restless habits, but nothing to lead to a suspicion of the fearful contention which may be going on within the mind. As in suicidal mania, many of those who are in habits of daily intercourse with the patients have been first astounded by the act of murder, and then only for the first time led to conjecture that peculiarities of language or conduct, scarcely noticed at the time, must have been symptoms of insanity. Occasionally the act of murder is perpetrated with great deliberation, and apparently with all the marks of sanity.

In *Reg.* v. *Vyse* (C. C. C., July, 1862), the prisoner, a respectable woman, was charged with the murder of her two children, by poisoning them with strychnine. The act was done with great deliberation and forethought; the poison was purchased under false pretences, and there was an entire absence of motive. She was acquitted on the ground of insanity. This was considered to be a case of impulsive mania, as there was nothing to indicate intellectual insanity. There was an hereditary tendency to insanity, coupled with the effects of prolonged nursing and general constitutional debility; but Hood's minute inquiries brought out facts which showed that the prisoner had laboured under disease which might have affected her mind, and have deprived her of the proper control of her actions. He states that on his first visit to her in Newgate, he learnt that, during the later months of suckling, she had been mentally overworked and subjected to great anxiety and fatigue. When worried by her business transactions, she suffered from a painful sensation seated in the interior of the cranium on the surface of the brain, and which she spoke of as 'perspiring of the brain'—a symptom often complained of by patients who suffer from mental disease, as giving a creeping, irritating feeling, but never more graphically described than by Mrs. Vyse. It is indicative of morbid action of the brain, which is manifested by examination after death. He considered Mrs. Vyse to be suffering from cerebral disease, which rendered her, at the time of the murders, an irresponsible agent.

The impulse to violence may be dormant for weeks or months, and then show itself by suicidal or homicidal acts; but such is the result, and not the proof, of mental disease. The case of *Christiana Edmunds* (*Reg.* v. *Edmunds*, C. C. C., Jan. 1872) is in this respect of some interest. The woman, æt. 43, moving in a respectable sphere of society, was charged with the murder of a boy at Brighton, on June 12, 1871. The deceased ate some sweets purchased in a confectioner's shop, died in a short time with the symptoms of poisoning with strychnine, and strychnine was found in his stomach. The prisoner had procured sweets from this shop by the agency of little boys, had deliberately poisoned them with strychnine, and returned them to the shop. She had herself on various occasions left poisoned sweets about in shops. How many persons had suffered from this cold-blooded and reckless act is not known; but she had previously attempted to poison the wife of a medical man, and she imputed the poisonings to the carelessness of the confectioner. He was able to show that his sweets as purchased were wholesome, and, by a chain of circumstances, the crime of poisoning them was clearly fixed upon the prisoner. She had shown much cunning in her proceedings. She had procured strychnine on four different occasions under false pretences, had borrowed the poison-book of a druggist, and torn out the leaves to conceal the fact that she had purchased the poison. The defence was insanity, but there was no proof of intellectual insanity about her. She had shown all the skill of an accomplished criminal in carrying out her plan of general poisoning, and in using the most artful means to conceal it and to throw the imputation upon the confectioner. Impulse could hardly be pleaded, for her criminal acts were extended over weeks and months. She was convicted. She then, with a view of averting or delaying punishment, put in a false plea of pregnancy in bar of execution. The capital sentence was subsequently remitted, and the prisoner was sent to Broadmoor Asylum, on the statement that she was of unsound mind. It appears that her father had died in a lunatic asylum when of middle age, having suffered for years before his death from homicidal and suicidal mania; her brother died at Earlswood Asylum, an epileptic idiot; her grandfather was a subject of cerebral disease; her sister suffered from hysteria; other relations were afflicted with nervous diseases of some kind; and she herself appears to have exhibited, some eighteen years before, symptoms of hysteria and hysterical paralysis. ('Lancet,' 1872, i. pp. 89, 107, 734; and 'Med. Times and Gaz.,' 1872, i. pp. 71, 101, 111.) This proved hereditary tendency to insanity in her family, and was the main cause of the commutation of the capital sentence. If we except the nature of the crime, showing as it did an utter recklessness for human life, there was nothing to indicate unsoundness of mind, either in a medical or a legal sense in this woman. The only evidence of insanity would be the atrocity of the act itself; but on this ground *Mary Ann Cotton*, executed at Durham for murder by poison, might have equally been pronounced insane. There was evidence that this woman had destroyed with arsenic, in the most reckless manner, children, husband, relatives, and friends, to the number of twenty persons. She sent her son, for whose murder she was tried, to procure the poison with which she subsequently killed him; but this woman was condemned and executed. She could not plead hereditary taint or hysteria of ancient date.

These cases are rendered difficult by the fact that there may be no distinct proof of the existence, past or present, of any disorder of the *mind*, so that the chief evidence of mental disorder is the *act* itself; of the existence of insanity, in the common or legal acceptation of the term, before and after the perpetration of the crime, there may be either no evidence whatever, or it may be so slight as not to amount to legal proof. Such cases are regarded and described by some medico-legal writers as instances of *insanity of the moral feelings* only, and this condition has been called '*Moral insanity*,' *mania sine delirio* (p. 721, *ante*). Its existence, as a state independent of a simultaneous disturbance of the reason or intellect, is denied by the majority of lawyers, as well as by some medical authorities. Whether such a condition exists or not is a simple question of fact, to be established if possible by clear and conclusive evidence. Its existence in the case of a person charged with murder appears to have rested hitherto too much on a mere medical dictum. Intelligible reasons have rarely been assigned by those witnesses who have sought to satisfy a court of law that this has as distinct an existence as intellectual insanity; in general, it is only alleged, and not proved to exist in a given case. If its existence were satisfactorily established, it would, as Stephen, J., observes, do away with one of the essential ingredients of crime—malice, and thus justify a jury in acquitting a person charged with murder. The accused on these occasions is assumed to have been an involuntary agent. It might be a good defence to admit that a man loaded a pistol and pointed it at the head of another, but that it was fired by a sudden involuntary action of the necessary muscles, and not by the prisoner's will. The only difficulty is to get a jury to believe it. The evidence given in support of the assertion that a man is morally insane, generally speaking, is at least as consistent with the theory that he is a great fool and a great rogue, as with the theory that he is the subject of a special disease the existence of which is doubtful. ('Crim. Law,' p. 95.) There is no doubt that the unrestricted admission of such a theory would go far to do away with all punishment for crime, for it would render it utterly impossible to draw a line between (moral) insanity and moral depravity. What is crime but the perversion of moral feelings? Moral insanity in a person of *sound mind* is a contradiction in terms.

In dealing with this subject, Orange, the superintendent of Broadmoor Criminal Lunatic Asylum, thus expresses himself: 'Moral depravity, it has been said, cares not for law; moral insanity cares, but cannot obey; but even if this were admitted as a direct distinction, it would still be necessary to prove that such inability to obey arises from defect of judgment or of will or of self-control, as a result of mental disease.' ('Relation of Insanity to the Criminal Law of England,' 1877, p. 10.)

Examination of Maniacs.—Homicidal mania may coexist with a quiet exterior, disarming all suspicion. Medical men when required to examine patients cannot be too distrustful in dealing with them. With astounding cunning they will prepare and conceal weapons of destruction, which may be used in an instant and without warning. The case of *Reg.* v. *McKane* (Salisbury Sum. Ass., 1873) furnishes a proof of the difficulty of guarding against sudden acts of violence. The prisoner was charged with the murder of Mr. Lutwidge, a Commissioner in Lunacy. The prisoner had been confined in an asylum for many years. He was anxious to be removed from the Fisherton Asylum, where he then was, and to go to Broadmoor. He had threatened to do something which would send him to some other place, but he had not been treated as a dangerous lunatic. As the Commissioner was going round the asylum with others for the purpose of inspection, the prisoner suddenly made a rush at him, and struck him violently on the temple with a large nail wrapped in a cloth. It penetrated to the brain of deceased, and he died in a week afterwards. Medical evidence was given to show that the prisoner was suffering from chronic mania; that he was subject to delusions, and that he was not responsible for his actions on this occasion. The border-line between sanity and insanity is so thin, that even experienced persons who have been all their lives associated with the insane may be deceived, when in reality the mind is unsound and the patient unsafe. A Commissioner in Lunacy, deeply impressed with the conviction that a patient in the asylum which he was visiting was perfectly sane and fit to be discharged, in defiance of the physician's warning, trusted himself alone in the lunatic's company, for the purpose, as he said, of a private conversation. In less than five minutes after they were alone, and, as the lunatic believed, unobserved, the Commissioner was throttled by his companion, and, but for the timely intervention of the physician, who had been a secret spectator of the scene, he would have been strangled. Some years since, Vance, an eminent surgeon, called to see a lunatic patient. When he had reached the top of the stairs, the patient suddenly rushed at him and threw him down the flight, killing him on the spot.

Tardieu lays down the following formula for the examination of lunatics:—1. *Mental state:* Three orders of facts should be investigated. (1) The intellectual troubles. (2) The perversion of the affective faculties and the instincts. (3) Alteration of the sensorial functions. 2. *Somatic state:* The position, attitude, walk, gestures, dress, malformation of the head, physiognomy, expression.

Homicidal mania, in its more common form, may make its appearance at all ages, even, it is said, in children: it is occasionally periodical, and the paroxysm of insanity is preceded by symptoms of general excitement. The patient experiences colicky pains, and a sense of heat in the abdomen or chest; headache, restlessness, loss of appetite, and lowness of spirits; the face is flushed or pale, the pulse hard and full, and the whole body is in a state of convulsive trembling. An act of violence is committed without warning, and the patient appears as if relieved from some oppressive feeling. He may be calm, and express neither regret, remorse, nor fear; he may coolly contemplate his victim, confess the deed, and at once surrender himself to justice. In some rare instances, he may conceal himself, hide the weapon, and, like a sane criminal, endeavour to obliterate all traces of the crime—thus showing a perfect consciousness of the illegality or wrongfulness of the act, and a desire to evade discovery. These are, however, the main features of crime, and unless there is independent evidence of *mental* disorder, or of some bodily disease affecting the brain and destroying the power of self-control, the conclusion must be that the person is sane and responsible. The great problem to be solved on these occasions is—What are the plain practical distinctions between defective reasoning power arising from disease and perverted moral sense? The latter condition alone should not exculpate a person or absolve him from punishment, or persons undeniably sane who have committed crimes should be equally exculpated and absolved from punishment.

The symptoms above described have been observed to be more aggravated in proportion as the homicidal impulse was strong. The propensity to kill is sometimes a fixed idea, and the patient can no more banish it from his thoughts than a person afflicted with insanity can divest himself of the delusive ideas which occupy his mind. (Esquirol, vol. 2, p. 105.) It has been supposed that Esquirol here implies a state in which there is no perversion of *intellect*. The facts which he mentions, however, clearly prove the contrary; for if a patient has not the power to banish from his thoughts this propensity to kill, he has passed beyond the bounds of reason, and is really insane. The admission of this fact proves that his mind must be unsound. Esquirol says, before the perpetration of the act there may be no sign of irrational conversation or conduct; but he asks the question—Because there is no proof of irrationality, are we to assume that these persons possess reason? Is it possible to reconcile the existence of a rational state of mind with the murder of those who are most dear to them? (Op. cit., vol. 2, p. 102.) In Esquirol's view, therefore, it may be taken that mere perversion of *feelings*, irrespective of some latent aberration of *intellect*, does not exist, and moral insanity is a conventional term for a state in which the proofs of mental disturbance are not so clear as in the generality of cases.

An erroneous notion prevails in the public mind, that a homicidal lunatic is easily to be distinguished from a sane criminal by some *certain* and invariable symptoms or characters, which it is the duty of a medical witness to display in evidence, and of a medico-legal writer to describe. But a perusal of the evidence given at a few trials will surely satisfy those who hold this opinion, that each case must stand by itself. It is easy to classify homicidal lunatics, and say that in one instance the murderous act was committed from a motive—*i.e.* revenge or jealousy; in a second from no motive, but from irresistible impulse; in a third from insane delusion; in a fourth from perverted moral feeling, without any sign of intellectual aberration. This classification may comprise all the varieties of homicidal insanity, but it does not help us to ascertain, in a doubtful case, whether an act was or was not committed under any of these psychological conditions. It enables us to classify those who are *acquitted* on the ground of insanity, but it entirely fails in giving us the power to distinguish a sane from an insane criminal, or a responsible from an irresponsible agent. According to Esquirol, whose views, more or less modified, are adopted by most writers on the medical jurisprudence of insanity, the facts hitherto observed indicate *three degrees* of homicidal mania:—

1. In the *first* degree the propensity to kill is connected with absurd or irrational motives or with *actual delusion*. The person would be at once pronounced insane. Cases of this description are not uncommon, and they rarely create any difficulty.

2. In the *second* degree, the desire to kill is connected with *no known motive*. It is difficult to imagine a rational motive for the deed; the person appears to have been led on by some impulse. There may have been *delusion* at the time, but there is no evidence of the preexistence of this. With respect to this class of cases, Stephen, J., observes, 'There are motives for all acts even the maddest, but it is frequently impossible to assign them specifically. It is, however, generally possible to form an opinion whether a given act was done from some unknown mad motive, or from some unknown sane motive.'

3. In the *third* degree, the impulse to kill is *sudden*, instantaneous, unreflecting, and *uncontrollable*. The act of homicide is perpetrated without interest, without motive, and often on persons who are most fondly loved by the perpetrator. It is this form, which has been called 'impulsive insanity,' which has given rise to so much contention on trials for murder in which insanity is set up as a defence, and therefore it will be well to consider this subject in a legal aspect. Stephen, J., thus comments upon it: 'It is said that on particular occasions men are seized with irrational or irresistible impulses to kill, to steal, or to burn, and under the influences of such impulses they sometimes commit acts which would otherwise be most atrocious crimes. It would be absurd to deny the possibility that such impulses may occur, or the fact that they have occurred and have been acted on. Instances are given in which the impulse was felt and resisted. The only question which the existence of such impulses can raise in the administration of criminal justice, is whether the particular impulse was *irresistible* as well as *unresisted*. If it was irresistible, the person accused is entitled to be acquitted, because the act would not then be voluntary and not properly his act. If the impulse was *resistible*, the fact that it proceeded from disease would be no excuse at all. If

a man's nerves were so irritated by a baby's crying that he instantly killed it, his act would be murder; it would not be less murder if the same irritation and corresponding desire were produced by some internal disease. The great object of the criminal law is to induce people to control their impulses; and there is no reason why, if they can, they should not control insane as well as sane impulses. The proof that an impulse was irresistible depends on the circumstances of the particular case. The commonest and strongest cases are those of women who, without motive or concealment, kill their children after recovery from childbed.'

In a case tried at the Stafford Assizes (*Reg.* v. *Humphreys*, Nov. 1878), in which a man was charged with the murder of his wife, the medical evidence was to the effect that the prisoner was suffering from epileptic mania, of which an irresistible homicidal impulse was one of the features. Bramwell, J., in summing up said everybody was presumed to be sane until proved to be the contrary. Nor was it enough that a man was mad to entitle him to an acquittal. If an insane man knew he was committing murder, that man was responsible. It was not enough to have a homicidal mania. The object of the law was to guard against mischievous propensities and homicidal impulses. A man might be suffering under a just sense of some grievous wrong or outrage which would impel him to violence, but that strong impulse, sane or insane, would not entitle him to an acquittal. He said this to the jury in order to disabuse their minds of a mischievous impression which existed, and which he believed had reached mad people themselves. He did not believe in uncontrollable impulse at all, and had never heard of such an impulse leading to action where the means of prevention were present. The jury acquitted the accused on the ground of insanity, and the judge expressed his full concurrence in the verdict. There was no direct proof of mental disease, but there was want of motive and an absence of any indication of ill will against the wife.

The three forms in which a homicidal propensity may thus present itself in cases of insanity differ from each other only in degree—the first two being strongly analogous to, but lighter modifications of, the third. All the cases which came before Esquirol had these features in common—an irritable constitution, great excitability, singularity or eccentricity of character; and, previously to the manifestation of the homicidal feeling, there was a gentle, kind, and affectionate disposition. As in other forms of insanity, there was some well-marked *change of character* in the mode of life; and, this may be taken as a proof that there must have been some degree of intellectual disturbance. The period at which the disorder commenced and terminated could be easily defined, and the attack could be almost always referred to some moral or physical cause. Attempts at suicide preceded or followed the attacks: all wished to die, and some desired to be put to death like criminals. In none of the cases was there any discoverable motive for the act of homicide.

Esquirol believed that there are well-marked distinctions between this state and that of the sane criminal. Among these he enumerates:

1. The want of accomplices in homicidal mania. 2. The sane criminal has *always* a motive—the act of murder is only a means for gratifying some other more or less criminal passion, and is almost always accompanied by some other wrongful act: the contrary exists in homicidal mania. 3. The victims of the criminal are those who oppose his desires or his wishes; the victims of the maniac are among those who are either indifferent to or who are the most dear to him. 4. The sane criminal endeavours to conceal, and, if taken, denies, the crime; if he confesses it, it is only with some reservation, and when circumstances are too strong against him; but he commonly denies it to the last moment: it is the reverse with the maniac. The exceptions to which these characters are open will be considered hereafter. They have, undoubtedly, greater value in their combined than in their individual application, and when in any case they coexist, there is strong reason to believe that the person accused of murder is labouring under homicidal mania. The great difficulty in these cases, however, is to distinguish *moral depravity* from *insanity*. We agree with a medico-legal writer on this subject, that 'no hideousness of depravity can amount to proof of insanity, unsupported by some evidence of a judgment incapacitated, or of a will fettered by disease. In those cases in which the emotions are perverted, and where there is no clear proof of *deranged intellect*—cases which do from time to time occur—the presumption of insanity in regard to a criminal action has to be upheld by evidence of a suspension of the will from mental disease. If it can be proved that the act was not voluntary, this does away with its criminal nature.' But in many cases it is impossible to produce satisfactory evidence of the suspension of the will as a result of disordered mind: this suspension can in general be *assumed* only from the act itself—a dangerous assumption, and one that might lead to the confusion of crime with insanity, and to the exculpation of all criminals.

Legal Tests.—Admitting the existence of homicidal mania as thus defined, it may become a question how, when pleaded in defence for one charged with murder, it is to be practically distinguished from a case in which the crime has been perpetrated by a really sane person. Tests, both medical and legal, have been proposed; but, singularly enough, in no single instance has the Court for Crown Cases Reserved, or any other court sitting in banco, delivered a considered written judgment on the relation of insanity to criminal responsibility, though there are several such decisions as to the effects of insanity on the validity of contracts and wills. (Stephen.) Moreover, every judgment delivered during the last forty years has been founded upon an authority in many ways doubtful, namely, the answers given by the judges to questions put to them by the House of Lords, in consequence of the acquittal of *M'Naghten* on the ground of insanity, in 1843. Stephens, J., is of opinion that the authority of the answers is questionable, and that they leave untouched the most difficult questions connected with the subject. ('Hist. of Crim. Law of Eng.,' vol. iii. p. 154.) The questions and answers are as follows. Fourteen of the fifteen judges consulted joined in the answers.

Question I.—'What is the law respecting alleged crimes committed by persons afflicted with insane delusions in respect of one or more particular subjects or persons, as, for instance, where, at the time of the commission of the alleged crime, the accused knew he was acting contrary to law, but did the act complained of with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some supposed public benefit?'

Answer I.—'Assuming that your Lordships' inquiries are confined to those persons who labour under such partial delusions only, and are not in other respects insane, we are of opinion that, notwithstanding the accused did the act complained of with a view, under the influence of insane delusion, of redressing or revenging some supposed grievance or injury, or of producing some public benefit, he is nevertheless punishable, according to the nature of the crime committed, if he knew at the time of committing such crime that he was acting contrary to law, by which expression we understand your Lordships to mean the law of the land.'

Question II.—'What are the proper questions to be submitted to the jury when a person, afflicted with insane delusions respecting one or more particular subjects or persons, is charged with the commission of a crime (murder, for instance), and insanity is set up as a defence?'

Question III.—'In what terms ought the question to be left to the jury as to the prisoner's state of mind at the time when the act was committed?'

Answers II. and III.—'As these two questions appear to us to be more conveniently answered together, we submit our opinion that the jury ought to be told in all cases that every man is presumed to be sane and to possess a sufficient degree of reason to be responsible for his crimes, until the contrary be proved to their satisfaction. That to establish a defence on the ground of insanity, it must be clearly proved that, at the time of committing the act, the accused was labouring under such a defect of reason from disease of the mind, as not to know the nature and quality of the act he was doing, or, if he did know it, that he did not know that he was doing what was wrong. The mode of putting the latter part of the question to the jury on these occasions has generally been, whether the accused, at the time of doing the act, knew the difference between right and wrong; which mode, though rarely, if ever, leading to any mistake with the jury, is not, we conceive, so accurate when put generally and in the abstract, as when put with reference to the party's knowledge of right and wrong in respect to the very act with which he is charged. If the question were to be put as to the knowledge of the accused, solely and exclusively, with reference to the law of the land, it might tend to confound the jury by inducing them to believe that an actual knowledge of the law of the land was essential in order to lead to a conviction; whereas the law is administered on the principle that every one must be taken conclusively to know it without proof that he does know it. If the accused were conscious that the act was one which he ought not to do, and if that act was at the same time contrary to the law of the land, he is punishable, and the usual course, therefore, has been to leave the question to the jury, whether the accused had a sufficient degree of reason to know he was doing an act that was wrong; and this course we think is correct, accompanied with such observations and corrections as the circumstances of each particular case may require.'

Question IV.—'If a person under an insane delusion as to existing facts commits an offence in consequence thereof, is he thereby excused?'

Answer IV.—'The answer must, of course, depend upon the nature of the delusion, but making the same assumption as we did before, namely, that he labours under such partial delusion only, and is not in other respects insane, we think he must be considered in the same situation as to responsibility as if the facts, with respect to which the delusions exist, were real. For example, if under the influence of his delusion he supposes another man to be in the act of attempting to take his life, and he kills that man as he supposes in self-defence, he would be exempt from punishment. If his delusion was that the deceased had inflicted a serious injury to his character and fortune, and he killed him in revenge for such supposed injury, he would be liable to punishment.'

It would thus appear that the law, in order to render a man responsible for a crime, looks for a *consciousness of right and wrong, and a knowledge of the consequences of the act;* while the administration of justice rests on the principle that every one knows the law and fears its punishment. Thus the complete possession of reason is not essential to constitute the legal responsibility of an offender; and it is also to be inferred, from the results of several cases, that a man may be civilly incompetent, but sufficiently sane to be made criminally responsible. The proofs required in the two cases are essentially distinct.

It has been objected to this *legal test*, that it is insufficient for the purpose intended; it cannot, in a large majority of cases, enable us to distinguish the insane homicide from the sane criminal. Many *insane persons* have committed acts which they knew to be wrong, and of the criminality of which they were at the time perfectly conscious. They have been known to murder others, in order to receive the punishment of death at the hands of the law; and therefore they must have been conscious of the wrongfulness, or rather of the illegality, of the act which they were perpetrating, and have known that they were committing an offence punishable by the law of man. In short, the criminal nature of the act has often been the sole motive for its perpetration. ('Ann. d'Hyg.,' 1852, t. 1, p. 363.) It has been suggested, with some truth, that it is rather the imperfect or defective appreciation of the motives to right or against wrong action which leads to crime among the insane, and not the mere ignorance of right and wrong. Most lunatics have an abstract knowledge that right is right, and wrong wrong; but in insanity the voluntary power to control thought and actions, and to regulate conduct by this standard, is impaired, limited, or overruled by insane motives. A lunatic may have the power of *distinguishing* right from wrong, but he has not the power of *choosing* right from wrong. A criminal is punishable, not merely because he has the power of distinguishing right from wrong, but because he voluntarily does the wrong, having the power to choose the right. ('On the Relation of Insanity to the Crim. Law,' by Orange, 1877.)

Medical Tests.—The *tests* which have been proposed by medical jurists for detecting cases of homicidal mania are as follows:—

1. The acts of homicide have generally been preceded by other striking *peculiarities of conduct* in the person, often by a total change of character.

2. Those persons who are affected with it have in many instances previously or subsequently attempted *suicide*—they have expressed a wish to die or to be executed as criminals. These supposed criteria, when tendered as medical proofs of insanity in courts of law, have been repeatedly and very properly rejected. They are of too vague a nature for practical use, and apply as much to cases of moral depravity as of actual insanity; in short, if these were admitted as *proofs*, they would serve as a convenient shelter from punishment for many sane criminals.

3. *Motive for Crime.*—The acts are without *motive;* they are in opposition to all human motives. A man known to have been tenderly attached to his wife and children murders them; a fond mother destroys her infant. It is hereby assumed or implied that persons who are sane never commit a crime without an apparent motive, and that in the perpetration of a criminal act an insane person either never has a motive, or has one of a delusive nature only. If these propositions were true, it would be easy to distinguish a sane from an insane criminal; but the rule wholly fails in practice. In the first place, the non-discovery is here taken as a proof of the non-existence of a motive; while it is undoubted that motives may exist for many atrocious criminal acts without our being able to discover them—a fact proved by the numerous recorded confessions of criminals before execution, in cases in which, until these confessions were made, no motive for the perpetration of the crime had appeared to the acutest minds.

4. *Confession.*—The subsequent conduct of the person: he seeks no escape, delivers himself up to justice, and acknowledges the crime laid to his charge. This is commonly characteristic of homicidal mania; for by the sane criminal every attempt is generally made to conceal all traces of the crime, and he denies it to the last, or until he sees that denial can be no longer serviceable to him.

5. *Accomplices.*—The sane murderer has generally *accomplices* in vice or crime; the homicidal maniac has not. Upon this it may be observed that some of the most atrocious murders committed in modern times have been proved to be the acts of persons who had neither accomplices nor any assignable inducements leading to the commission of the crimes. It is, however, a fact so far in favour of the existence of homicidal insanity, that the *insane* never have accomplices in the acts which they perpetrate. These criteria can hardly be described as medical; they are circumstances upon which a non-professional man may form just as safe a judgment as one who has made insanity a special study.

6. *Delusion in the Act.*—The presence of *delusion* has been said to characterize an act of homicidal mania, while premeditation, precaution, and concealment have been considered to be the essential features of the act of a sane criminal. Some medical men think, if they discover anything resembling a delusion in the mind of an accused person, that he is necessarily irresponsible for the act, but the doubtful theory of the law, as supposed to be laid down by the judges in *M'Naghten's* case (see p. 780, *ante*), is that, notwithstanding a person labours under a delusion, if he commits an act which he knows to be contrary to law, he is liable to punishment; if the delusion be *partial*, the party accused is still responsible; and if the crime were committed for an imaginary injury, he would be held equally responsible. Much stress was formerly laid upon the *delusion being connected with the act* in cases of alleged insanity; but it must be remembered that, except by the confessions of insane persons during convalescence, it is not easy for a *sane mind* to connect the most simple acts of a lunatic with the delusion under which he is labouring. Every act of homicide perpetrated by an insane person is perhaps connected with some delusion with which he is affected; but it is not to be supposed that one who is sane can always discover this connection.

It may be further observed that premeditation, precaution, concealment, and flight are met with in crimes committed by both sane and insane criminals, although these acts are certainly strong characteristics of sanity. It should be a question for a jury whether, when they are proved to have existed in any criminal act, there might not have been such a power of self-control in the person, although in some degree insane, as to justify a conviction. It is not the presence of a slight degree of mental aberration which necessarily indicates a loss of power of controlling actions.

7. *A Number of Murders perpetrated at once.*—In the acts of sane criminals one person, or at the most two, may be destroyed; but, in cases of homicidal mania, it is not unusual to find a wife and several children killed by the husband, or four or five children at once destroyed by the wife. In these cases no motive but that which is based on some insane delusion, can be suggested for such a series of murders. Thus four infants may be found murdered by a mother, who admits the act, but endeavours to account for it by asserting that she wished to convert them into angels, or to save them from destitution and exposure to worldly temptations.

It would be wrong, however, to infer from this statement that, because a man has heaped crime upon crime, he is therefore insane. This would be equal to making the atrocity of the crime or crimes a test of insanity. In the case of Southey (*Reg.* v. *Southey*, Maidstone Wint. Ass., 1865), it was proved that the prisoner, a man of depraved habits, had destroyed three of his children in London, and had then proceeded to Ramsgate, and there deliberately destroyed his wife and another child. He pretended to justify these five murders, and wished to make it appear that he was insane. In regard to this man's conduct through life, nothing but moral depravity was proved. Still, he found medical defenders, who brought forward as proofs of 'delirium,' statements which clearly showed that they did not understand the meaning of the term. It was admitted that if the man had committed *one* of the murders, he might have been sane, but having committed five in succession, he was insane and incompetent to judge of the nature of his acts. The fallacy of such an argument needs no exposure. There could be no doubt of the sanity of *Rush*, who was tried and convicted of the simultaneous murder of three persons. (Norwich Lent Ass., 1849.) Thinking that he had a legal claim to an estate held by a Mr. Jermy, the prisoner went to the house, concealing his features with a mask, and there shot one after the other, Mr. Jermy, his son, his son's wife, and a maidservant, killing three of them. The defence of insanity was not set up. He was convicted and executed.

Summary.—The foregoing considerations lead to the inference that there are *no certain legal or medical tests or characters* whereby homicidal mania can be demonstrated to exist. Each case must be determined by the circumstances attending it; but the true criterion of irresponsibility appears to be whether the person, at the time of the commission of the crime, had or had not a *sufficient power of self-control to govern his actions*; or, in other words, whether he knew the act was wrong, and could avoid the perpetration of it. Stephen, J., expresses a similar opinion in stating that there should be proof of an *absence of the power of self-control*, caused by *disease* affecting the mind. This involves the consideration, not only whether insanity existed in the accused, but whether it had reached such a degree as to destroy, not merely a consciousness of the nature of the act, but volition—the will to do or not to do it. If from circumstances it can be inferred that an accused person had this power, whether his case falls within the above rules or not, he should be made responsible and liable to punishment. If, however, he was led to the perpetration of the act by an *insane* impulse, or, in other words, by an impulse which his mental condition did not allow him to control, he is entitled to an acquittal as an irresponsible agent. The power of controlling an act appears to imply the existence of such a state of sanity as to render the party responsible; and when there is this want of control, it may be fairly concluded that there is no sane intention, and that the person is irresponsible. A test somewhat similar to this is constantly applied by juries, under the direction of our judges, to distinguish murder from manslaughter; and it is quite certain that sanity and homicidal mania are not more nicely blended than those shades of guilt whereby manslaughter passes into murder. The manner and circumstances under which a crime is committed will often allow a fair inference to be drawn as to how far a power of self-control existed or was exercised. A man in a violent fit of mania or delirium rushes with a drawn sword into an open street, and stabs the first person whom he meets; another, worn out by poverty and destitution, murders his wife and children to prevent them from starving, and then probably attempts to destroy himself: these are cases in which there is a fair ground to entertain a plea of irresponsibility. But when we find a man, not showing any previous intellectual disturbance, lurking for days together in a particular locality, having about him a loaded weapon, watching a particular person who frequents that locality, not facing the individual and shooting him, but coolly waiting until he has an opportunity of discharging the weapon unobserved by his victim or others,—the circumstances appear to show such a perfect adaptation of means to ends, and such a power of controlling actions, that it is difficult to understand on what principle an acquittal on the ground of insanity could have been allowed. We refer here to the case *M'Naghten*, tried for the murder of *Mr. Drummond*, Jan. 1843. The acquittal in this case was the more remarkable because there was no proof of general insanity, and the crime was committed for a supposed injury. According to the rules laid down by the fifteen judges, from questions submitted to them in connection with this case, this man should have been convicted (*ante*, p. 780).

In cases of alleged homicidal mania, very vague meanings have been sometimes assigned to the term 'delusion.' In *Reg.* v. *Burton* (Maidstone Lent Ass., 1863), the prisoner, a youth of 18, was indicted for the murder of a boy at Chatham. There was no motive, but it was argued by his counsel, that he laboured at the time under a delusion—the delusion being a desire to be hanged. The surgeon of the prison stated that he had had frequent opportunities of examining the prisoner while in gaol, and in his opinion he was perfectly sane; so far as the witness could judge, he was under no delusion. The jury returned a verdict of 'guilty.' If the youth had believed that he had been already hanged for murder, this might have been considered a delusion; but a desire to be hanged, or to die from any violent cause, cannot be so regarded. The remarks of Wightman, J., upon this kind of defence contain all that is necessary to show its fallacy. In passing sentence upon the prisoner, he said, 'It is stated that you laboured under a morbid desire to die by the hands of justice, and for this purpose you committed the murder. This morbid desire to part with your own life can hardly be called a delusion; and, indeed, the consciousness on your part that you could effect your purpose by designedly depriving another of life, for which you knew you would have to suffer the punishment due to the greatest of crimes, shows that you were perfectly able to understand the nature and consequences of the act which you were committing, and that you knew it was a crime for which by law the penalty was capital. This was, in truth, a further, and I may say a deeper, aggravation of the crime: for you designedly intended to compass your own death by the murder of another.'

In forming a judgment of the mental condition of an accused person, it is no part of the province of a witness to modify his opinion according to the *punishment* which may follow if the plea be rejected; he should simply base it on the medical *facts* of the case. The legislature only is responsible for the punishment adjudged to crimes. Mayo justly observed that a medical witness is summoned to a court of justice in order to enable the judge and jury to arrive at certain practical conclusions. The question proposed to him involves a simple fact, and not its consequences; and if the latter consideration be entertained by him, it will be liable to bias his evidence on the fact, which is his legitimate topic. The definition of insanity becomes very expansive when its expansion may become protective to a criminal with whom we may happen to sympathize. The question whether the accused is a responsible agent is of a judicial nature: our evidence should be confined to the question whether the accused is *insane* in a certain sense or meaning in which it is understood and defined by law. A medical witness in these cases often moulds his evidence to a foregone conclusion on the criminal responsibility of the accused, and thus lays himself open to a remark from the judge that he must not encroach on the functions of the jury. It is certainly a great evil that, under the present mode of laying this question before a jury, the law operates unequally. One case becomes a subject of prominent public interest, and every exertion is made to construe the most trivial eccentricities of character into proofs of insanity, and to magnify the effects of an hereditary tendency by proving that a distant relative had been a lunatic: an acquittal follows. Another case may excite no interest: the accused is convicted, and either executed or otherwise punished, although the evidence of insanity, had it been as carefully sought for and brought out, would have been perhaps stronger in this than in the former instance.

The doctrine of 'irresistible impulse' and the theory of impulsive insanity have been strained in recent times to such a degree as to create in the public mind a distrust of medical evidence on these occasions. It is obviously easy to convert this into a plea for the extenuation of all kinds of crimes for which motives are not at once apparent, and thus medical witnesses often expose themselves to severe rebuke. They are certainly not justified in setting up such a defence, unless they are prepared to draw a clear distinction between impulses which are 'unresisted' and those which are irresistible. As a judge once remarked in his address to a jury, 'What is the meaning of not being able to resist an impulse? Every crime is committed under an impulse, and the object of the law is to compel persons to control or resist these impulses. If it is made an excuse for a person who has committed a crime, that he was goaded to it by some impulse which medical men might choose to say *he* could *not* control, such a doctrine would be fraught with very great danger to society.'

While the truth of these remarks is obvious, it must be admitted that the legal test for responsibility is not satisfactory. In addressing the jury in *Reg.* v. *Cockroft*, in a trial for murder (Leeds Aut. Ass., 1865), Mellor, J., made the following observations on the defence of insanity which had been set up: 'It would be dangerous if the idea went abroad that persons committing crime under sudden impulse were therefore to be excused. At the same time, he thought that the definition of insanity which would excuse from criminal responsibility, as given in *M'Naghten's* case, hardly went far enough. He was of opinion that a man might know that he was doing an act which was wrong, and still he might be labouring under such disease of the mind as not to be able to restrain his impulse to do that act, and he should therefore not be amenable to the criminal law. The mere fact, however, of the prisoner being ignorant and of a low type of mind would be no excuse. If the jury thought that the prisoner knew at the time when he committed the act that he was doing wrong, and was not labouring under such a disease of the mind as incapacitated him from controlling his impulses, he was not entitled to acquittal on the ground of insanity. The doctrine of uncontrollable impulse, as laid down by some writers, was a very dangerous one, and required to be watched with the utmost care. Passion arising from provocation, however trivial, offered to a mind however ill regulated, did not relieve the person from criminal responsibility.' Hence it follows that a man might know that he was doing wrong and committing an act against the laws of God and man, yet if with this consciousness of the illegality of the act there was a *diseased condition of mind* which prevented him from controlling his actions, he will be entitled to an acquittal on the ground of insanity. With this admission, it is unnecessary to occupy space with metaphysical discussions regarding criminal responsibility; for however objectionable the theory—if the *practice* of the law be in any one case in conformity with that which has been advised by writers on the Medical Jurisprudence of Insanity, although it may be even adverse to the theory on which it is professedly based, this is all with which we have to concern ourselves—the principle is admitted. The great defect in the English criminal law is, not that it will not go even to the full extent of exculpating a person who has committed a crime with a knowledge of its illegality, and under what is called an 'uncontrollable impulse,' or an impulse which, owing to mental disease, his reason was not sufficient to control, but the *uncertainty of its application*. There are many cases reported which show that an acquittal on the ground of insanity, in a trial for murder, is frequently a mere matter of accident.

Numerous trials for murder have within the last few years taken place in which there have been acquittals on the ground of insanity, and the accused confined during her Majesty's pleasure. In some of these epilepsy has been associated with insanity. The details of these cases present no striking difference from those recorded in the text, with the exception of one, in which a man who had been a lunatic and had recovered was tried on a charge of murder and acquitted on the ground of insanity. (*Reg.* v. *Blampied*, Maidstone Sum. Ass., 1875.) The prisoner was charged with the wilful murder of a fellow-labourer named Catt. Blampied became insane in Dec. 1868, was confined in an asylum, from which he was discharged as cured in Dec. 1872, and had ever since worked at his trade in a proper manner. The deceased man was often associated with him, and some months previously a quarrel had taken place between them, but it was not serious, and they were apparently on friendly terms. In April, 1875, they were working within six feet of each other, when the prisoner, without any known provocation, struck the deceased violently with an adze on the back of the head, fracturing his skull and causing his death. The man pleaded not guilty, with every appearance of sanity. In the defence it was urged that he was not responsible for the act on the ground of insanity. Brett, J., told the jury that the law took no heed of sanity or insanity abstractedly considered, or of the presence or absence of delusions. To exempt from responsibility, a man must be so mad as not to know the nature of the act he committed. If he knew what he was doing, and if he knew that it was wrong, then, however mad he might be, he was still responsible. He also remarked that for three years previously the prisoner had been sane, and had been treated as sane by his associates. These remarks pointed clearly to a conviction, but the jury, after consulting for a short time, found a verdict of guilty, but that the prisoner was not accountable for his acts; in other words, they acquitted him on the ground of insanity. This shows that on these occasions a jury may decline to accept the legal rule of responsibility as here laid down, and act upon their own judgment.

From the number of acquittals which annually take place on the ground of insanity, it will be understood that Broadmoor and other county asylums have a large population of criminal lunatics. In 1883, there were 535 in Broadmoor. In 1881, five murderers were discharged from Broadmoor, and six died. It thus appears that nearly half our lunatic murderers are eventually set at liberty.

CHAPTER 67.

PUERPERAL MANIA.—PYROMANIA.—KLEPTOMANIA.—DIPSOMANIA.—RESPONSIBILITY OF DRUNKARDS.—DELIRIUM TREMENS.—SOMNAMBULISM.—THE DEAF AND DUMB.

Puerperal Insanity.—Mania may present itself in other forms than those hitherto considered. Women who have been recently delivered are liable to sudden attacks, in which a disposition to murder their offspring is the most marked symptom. This has been long known and recognized by physicians as 'puerperal mania.' The disorder seldom attacks a woman before the third day, often not for a fortnight, and in some instances not until several weeks after delivery. Out of ninety-two cases, Simpson observed that the attack occurred in twenty-one between the fifth and the fifteenth day. ('Med. Times and Gaz.,' 1860, ii. p. 201.) The most frequent period is at or about the commencement of lactation, and between that and the cessation of the uterine discharges. According to Esquirol, it is generally preceded or attended by a suppression of the lochia and milk. Ashwell remarked that undue lactation might give rise to an attack of mania, under which the murder of the offspring might be perpetrated. ('Dis. of Women,' p. 732. See the case of *Reg.* v. *Lacey*, Nottingham Sum.

Ass., 1858.) It may also come on after forced or voluntary weaning.

The *symptoms* do not differ from those of mania generally, but it may assume any of the other forms of insanity; and, in one-half of the cases, it may be traced to hereditary tendency. There is a childish disposition for harmless mischief. The woman is gay and joyous, laughing, singing, loquacious, inclined to talk obscenely, and careless of everything around. She imagines that her food is poisoned; she may conceal the suspicion, and merely avoid taking what is offered to her. She can recognize persons and things; and can—though perhaps she will not—answer direct questions. Occasionally there is great depression of spirits with melancholia. These facts are of some importance in reference to cases of alleged child-murder. This state may last a few hours, or for some days or weeks. The murder of the child is generally either the result of a sudden fit of delirium or a sudden impulse, with the full knowledge of the wickedness and illegality of the act; so that the legal test of responsibility, *i.e.* a knowledge of right and wrong, cannot be strictly applied to such cases as these, except on the assumption that insanity already exists and affects the consciousness of the individual. A woman has been known to request her attendants to remove the child, but she has afterwards taken an opportunity to destroy it. In such cases of deliberate child-murder there is no motive, no attempt at concealment, nor any denial of the crime on detection. There is in general a full consciousness of the illegality of the act, but apparently an entire want of power to control the murderous feeling.

Women in the *pregnant* state have been known to perpetrate murder, apparently from some sudden perversion of their moral feelings: there has been probably latent intellectual disturbance, but not sufficient to attract the notice of friends. There is such a sympathy between the uterine organs and the brain as may account for the occurrence of such cases; but we are not aware that irresponsibility on the ground of insanity, unless there were independent proofs of this condition, has been admitted in this country. It would be unsafe to act on such a principle. On the occurrence of pregnancy, mania, melancholia, and other disordered and capricious states of mind, may show themselves in women predisposed to attacks of this kind; but it cannot be admitted that the pregnant state produces *per se* a disposition to rob, steal, or murder. An intelligent woman, æt. 29, who was advanced in pregnancy, felt a strong desire to murder her three children, to whom she was fondly attached. She informed her husband and her medical attendant of this feeling, which haunted her in spite of every effort to shake it off. She was sent away from the children. Such feelings, when they cannot be controlled, and the current of thought changed, indicate the existence of incipient mania. There can be no doubt that, as a rule, a pregnant woman possesses a free will just as in the ordinary condition, and that she is as fully conscious of her actions. Stolz affirms that since this doctrine of responsibility in reference to pregnant women has been made known by medical men, there has been a cessation of criminal acts on the part of these women. ('Ann. d'Hyg.,' 1873, t. 2, p. 149).

Pyromania.—This is described as a form of insanity in which there is a morbid disposition of mind leading to impulsive acts of incendiarism without any motive. It is a condition not specially recognized by English jurists or in English courts of justice.

Kleptomania. Propensity to Thieve.—This term has been applied by Marc to that form of insanity which is said to manifest itself by a propensity to acts of theft. It is alleged by him and others that this propensity has often shown itself in women labouring under disordered menstruation, or among those who were far advanced in pregnancy—the motive being the mere wish of possession. It is not, however, confined to the female sex. Pregnancy, according to him, should be a good exculpatory plea when a well-educated woman, of strictly moral conduct, steals some unimportant article of no value to herself, compared with her worldly means and position in society. There are several instances on record showing that well-educated persons moving in a respectable sphere of society have been guilty of petty acts of theft. The articles taken have been valueless compared with their means. Instances of this kind have been brought before our police-courts, and this motiveless impulse to theft has been occasionally pleaded; but in most of them the following facts have been established by evidence:—1. A perfect consciousness of the act and of its illegality. 2. The article, though of trifling value, has still been of some use to the person: thus women have stolen articles either adapted to female use or on which money could be raised. 3. There have been art and precaution in endeavouring to conceal the theft. 4. Either a denial of the act when detected, or some evasive excuse. When circumstances of this kind are proved, either the persons charged with stealing should be made responsible, or theft should be openly tolerated. The evidence of a disordered state of mind should not be allowed to depend on the nature of the act, or every morally depraved person might bring forward a plea of insanity for any crime or offence. In a trial which took place at the Middlesex Sessions, in Aug. 1878, a man was charged with stealing a portmanteau from a railway station. In his defence, the prisoner said that he was a kleptomaniac; but the plea did not avail him. This case shows that Marc's suggestion has reached the class of common thieves. When the facts proved really justify a plea of insanity in a case of stealing, the rule appears to be (Tindal, C.J.), that there should be proof that the prisoner was incompetent to know that the particular act in question was a wrong one. (*Reg.* v. *Vaughan*, Monmouth Sum. Ass., 1844.) When there is satisfactory evidence on this point, the person will be acquitted on the ground of insanity. This is shown by the following case, which was tried at the Middlesex Sessions, Feb. 1875. A clergyman named *Hall*, well educated, was charged with stealing two pairs of ladies' gloves. The prisoner entered a glove-shop in the evening, and asked to look at some dress-gloves. He was shown a box, but expressed a wish for a darker colour. While the shopwoman turned for the purpose of getting them, he took three pairs from the drawer, and concealed them in his pocket. He at first denied that he had them; offered to pay for them, and tried to leave; but was detained. When before the magistrate, he said he was liable to attacks on the brain, at which times he did not know what he was doing. Tuke deposed that some years before he had on two occasions attended the prisoner for disease of the brain. He was a man of high attainments. He had recently seen him, and found him suffering from brain-disease, so that at times he was quite mad. He believed that the prisoner did not know the nature or quality of the act he committed at the time of its commission, and that his opinion of the mental state of the prisoner was not affected by hearing the evidence for the prosecution. The jury found a verdict of not guilty, on the ground of insanity; and he was ordered to be detained during her Majesty's pleasure. Although the prisoner had shown in the act the usual cunning of thieves in stealing behind the back of the vendor, in trying to conceal the theft, denying it, and trying to escape, the evidence was very conclusive in showing that he laboured under mania. The articles stolen were not such as he could use or wear, and of only paltry value.

Dipsomania. Drunkenness. Civil Responsibility of Drunkards.— This state, which is called in law frenzy, is regarded as a temporary form of insanity. Jurists and legislators have differed widely respecting the degree in which drunkards should be made responsible for their acts. When the mind of a man is completely weakened by *habitual* drunkenness, the law infers irresponsibility, unless it plainly appears that the person was at the time of the act, whether of a civil or of a criminal nature, endowed with full consciousness and reason to know its good or evil tendency. Any *deed* or *agreement* made by a person when drunk is not invalidated by our law, except in a case in which the intoxication has proceeded so far as to deprive him of all consciousness of what he is doing; and a court of equity will not interfere in any case, unless the drunkenness is proved to have been the result of collusion by others for the purposes of fraud. When the drunkenness has occasioned a temporary loss of the reasoning powers, the person is incapable of giving valid consent, and therefore cannot enter into a contract or agreement, for this implies a mutual assent of the parties. Partial drunkenness, therefore, provided the person knew what he was about, does not vitiate a contract or agreement into which he may have entered. Thus the law appears to define two states in drunkenness: one in which it has proceeded to but a slight extent, and it is considered that there is still a power of rational consent; another in which it has proceeded so far that the person has no consciousness of the transaction, and therefore can give no rational consent. The proof of the existence of this last state would render all the civil acts of a person void (see p. 768, *ante*). A confession made by a man while in a state of drunkenness is legally admissible as evidence against him and others, provided it be corroborated by circumstances. In a case tried a few years since, the prisoner confessed, while drunk, that he had committed a robbery and murder which had taken place some time before, but of which he had not been suspected. He mentioned a spot where the property of the murdered person had been concealed by him, and the whole of the circumstances of the murder. The property was found as he had described it, and the case was clearly brought home to him, chiefly by collateral evidence from his own confession. He was convicted. In one case (C. C. C., Oct. 1849), a man pleaded his drunkenness at the time of his first marriage as a defence to a charge of bigamy. There was evidence to show that he was partly intoxicated when the ceremony was performed; it was proved, however, that he was sufficiently conscious of the whole of the proceedings, and he was convicted. ('Lond. Med. Gaz.,' vol. xliv. p. 762.)

By a recent enactment, the Habitual Drunkards Act, 1879 (42 & 43 Vict., c. 19), a person given to drink may voluntarily enter a retreat provided for such persons for a definite period, not exceeding twelve months; and, having thus voluntarily placed himself under restraint, he cannot leave the house of retreat until the expiration of the stipulated time.

Criminal Responsibility of Drunkards.—When *homicide* is committed by a man in a state of *drunkenness*, this is held to be no excuse for the crime. If voluntarily induced, whatever may be its degree, it is not admitted as a ground of irresponsibility, even although the person might not have contemplated the crime when sober. (*Reg.* v. *Reeves*, Derby Wint. Ass., 1844.) Thus it appears that when the state of drunkenness is such that any civil act would be void, a person may still be held legally responsible for a crime like murder. Some judges have admitted a plea of exculpation when the crime has been committed in a state of frenzy arising from *habitual drunkenness;* but even this is not general. The question whether the person was or was not drunk at the time of committing the crime may be, however, occasionally of some importance. It was held by Paterson, J., that, although drunkenness is no excuse for any crime whatever, yet it is of very great importance in cases in which there is a question of *intention.* A person may be so drunk as to be utterly unable to form any intention at all, and yet he may be guilty of very great violence. (*Reg.* v. *Cruse.*) If the drunkenness has produced a diseased state of the mind, then a criminal act perpetrated by the person might admit of exculpation, either on the ground of insanity or of the want of sane consciousness at the time of the act; but the difficulty is to prove in such cases the existence of actual disease in a sufficient degree to render the person irresponsible in a legal sense. When it is a question whether the accused was actuated by malice or not, a jury may, under certain circumstances, be required to take the fact of drunkenness into their consideration, and this may have some influence upon their verdict. While, then, drunkenness does not furnish any excuse for a crime, it may become material with reference to the *intent* with which a crime has been perpetrated. ('Law Times,' Sept. 27, 1845, p. 542.) It is obvious that, if drunkenness were to be readily admitted as a defence, three-fourths of the crimes committed in this country would go unpunished.

In cases in which the head has sustained any physical injury, as among soldiers and sailors, drunkenness, even when existing to a slight extent, produces sometimes a fit of temporary insanity, leaving the mind clear when the drunken fit is over. The law makes no distinction between this state and ordinary drunkenness, although juries occasionally show by their verdicts that some difference ought to be made.

Hallucinations and illusions are a common effect of drunkenness, and may lead to the commission of criminal acts. Marc relates a case where, two friends being intoxicated, the one killed the other under an illusion that he was an evil spirit. The drunkenness of the accused was held to have been voluntary; and he was condemned. A case of this description (*Reg.* v. *Patteson*) was tried at the Norfolk Lent Ass., 1840. A man while intoxicated killed his friend, who was also intoxicated, under the illusion that he was some other person who had come to attack him. It is reported that the guilt of the prisoner was made to rest upon the fact whether, had he been sober, he would have perpetrated the act under a similar illusion. As he had voluntarily brought himself into a state of intoxication, this was no justification; and he was found guilty of manslaughter.

The proof of drunkenness may fail, but still, if the person charged with the death acted under an illusion, he will be acquitted. In *Reg.* v. *Price* (Maidstone Sum. Ass., 1846), it was proved that the prisoner, who had been on friendly terms with the deceased, was going home at night, having previously been in company with him at a public-house. According to the prisoner's statement, a man sprang upon him from the hedge by the roadside, and demanded his money and his watch, or else he said he would have his life; the prisoner closed with him and beat him severely, inflicting such injuries that he died shortly afterwards. The supposed robber turned out to be his friend, and it was believed that he had made an attempt to rob the prisoner jokingly; the result, however, was that the attempt had ended in this fatal manner. The prisoner throughout told the same story, and there did not appear to be the slightest ground for suggesting that it was untrue. Coltman, J., after hearing the evidence of the witness, said it appeared to be quite clear that the prisoner had acted under an impression that he was protecting his own life from the attack of a robber, and under such circumstances he could not be held to be criminally responsible. The jury accordingly returned a verdict of *not guilty*, and the prisoner was discharged.

Delirium Tremens.—This is a disordered state of mind proceeding from an abuse of intoxicating liquors. Habitual drunkenness is the predisposing, while abstinence from drink may be the immediately exciting cause. Thus the disorder frequently does not show itself until the accustomed stimulus has been withdrawn for a certain period. It commences with tremors of the hands, by which it is known from ordinary delirium and restlessness; and the individual is subject to hallucinations and illusions, sometimes of a horrible kind, referring to past occupations or events. The patients are often violent, and prone to commit suicide or murder—more commonly the former;

hence they require close watching. Persons proved to be labouring under this disorder are incompetent to the performance of any civil act; and they are not responsible for criminal acts committed while they are suffering from an attack. Acquittals have even taken place on charges of murder, when there was deliberation as well as an apparent motive for the act. Thus, then, although this disorder may have been voluntarily brought on by habitual drunkenness, the law admits it as a sufficient plea for irresponsibility, while in a case of confirmed drunkenness it rejects the plea. In delirium there is a formed disease of the brain, while voluntary drunkenness merely produces a temporary disturbance of its functions. In one trial the evidence showed that homicide had been committed by the accused while he was labouring under an attack of delirium tremens. (*Reg.* v. *Simpson*, Appleby Sum. Ass., 1845.) The prisoner's mind had become unsettled from this disorder, brought on by habitual drunkenness. In another case the plea was also admitted by the jury, although it was scarcely supported by the medical evidence. (*Reg.* v. *Watson*, York Wint. Ass., 1845.) In one case, *Reg.* v. *Burns* (Liverpool Sum. Ass., 1865), a man labouring under delirium tremens was charged with the murder of his wife. After the act, he appeared calm, and said that he knew perfectly well what he had done; 'his wife was in league with men who were hidden in the walls.' Bramwell, B., in charging the jury, said, 'there were two kinds of insanity by reason of which a prisoner was entitled to be acquitted; probably the jury would not be of opinion that the prisoner did not know the quality of his act—that it would kill, and was wrong; but it was still open to them to acquit him if they were of opinion that he was suffering from a delusion leading him to suppose that which, if true, would have justified him in the act. One more remark he would make—viz. that drunkenness was no excuse, and that a prisoner cannot by drinking qualify himself for the perpetration of crime; but if through drink his mind had become substantially impaired, a ground of acquittal would then fairly arise.' The prisoner was acquitted. In *Reg.* v. *Chaplin* (Warwick Ass., Nov. 1878), the prisoner was charged with felonious wounding by firing a revolver at two persons. It was proved that, at the time of the acts, the prisoner was suffering from an acute attack of delirium tremens, after sudden cessation from excessively hard drinking. Medical evidence also proved that at the time, and for two days after, he was in such a state that he would not know the nature of his acts. He fired the shots under the delusion that some one was breaking into the house. Upon this evidence the prisoner was found not guilty, on the ground of insanity. In another case (*Reg.* v. *M'Gowan*, Manchester Ass., Oct. 1878), it was proved that the prisoner, who was charged with the murder of his wife, had been drinking heavily for two or three weeks. The medical evidence was to the effect that he was suffering from temporary disease of the brain as a result of excessive drinking; that the man knew what he had done, as he had voluntarily given himself up for it; but that he was not accountable for his actions. Manisty, J., said if a man's insanity was so fixed, habitual, and permanent that it reduced him to a state of being without reason or mind, then he was not accountable or responsible for his actions. But if the prisoner's insanity was only temporary and produced by his own excesses, the law did not excuse him from the results of his acts. The man was found guilty. In a recent case (*Reg.* v. *Baines*, Leicester Ass., Jan. 1886), Day. J., ruled that if a man were in such a state of intoxication that he did not know the nature of his act, or that his act was wrongful, his act would be excusable.

As in one of the cases above noticed, an attack of delirium tremens may be brought on by the sudden withdrawal of alcoholic stimulants from a person long accustomed to take them in excess. The sudden abstinence from other narcotics, such as opium and hydrate of chloral, may induce a similar attack. A person might thus be rendered temporarily unconscious of his actions, and therefore legally irresponsible for an act of violence committed while he was in this state. A case occurred in Canada, in which this question arose in reference to hydrate of chloral. There is reason to believe that this drug would operate on the brain and nervous system in the same manner as alcohol, opium, and morphine. ('Guy's Hosp. Gaz.,' Jan. 1879, p. 9.)

Somnambulism.—This term strictly applies to sleep-walking, but the medico-legal facts are chiefly confined to acts of violence perpetrated unconsciously, or in a state of 'unconscious cerebration' during sleep, in which it is presumed that malice and intention, the chief ingredients of crime, are wanting. It has been a contested question among medical jurists, how far a person should be held responsible for an act perpetrated in that half-conscious state which exists when he is suddenly aroused from sleep. There is no doubt that the mind is at this time subject to hallucinations and illusions, which may be more active and persistent in some persons than in others; but it is difficult to suppose, unless we imagine there is a sudden access of insanity, that a person should not recover from the delusion before he could perpetrate an act like murder. A remarkable case of this description, that of *Bernard Schedmaizig*, will be found reported by Marc. This man suddenly awoke at midnight, and saw, as he believed, a frightful phantom. He twice called out, 'Who is that?' and receiving no answer, and imagining that the phantom was advancing upon him, he seized a hatchet which was beside him, attacked the supposed spectre, and killed his wife. He was charged with murder, but was pronounced 'not guilty,' on the ground that he was not at the time conscious of his actions. A pedlar in the habit of walking about the country armed with a sword-stick, while lying asleep on the high-road, was roused by a man accidentally passing, who seized and shook him by the shoulders. The pedlar suddenly awoke, drew his sword and stabbed the man, who died. The pedlar was tried for manslaughter. His irresponsibility was strongly urged by his counsel, on the ground that he could not have been conscious of an act thus perpetrated while in a half-waking state; and this defence was supported by the opinion of a medical witness. The prisoner was, however, found guilty. Under such circumstances, it was not unlikely that an idea had arisen in the prisoner's mind that he had been attacked by robbers, and therefore had stabbed the man in self-defence. (*Rex* v. *Milligan*, Lincoln Aut. Ass., 1836.) In July, 1878, one *Simon Fraser* was tried in Scotland for the murder of his child. It was proved that he lifted the child from its bed, and killed it by dashing its head against the wall of the room. The defence was that it was done unconsciously, while he was in a state of somnambulism. He dreamed that he had seen a wild beast jump into his bed, and he rose to attack it. It seems that from boyhood he had been accustomed to get up in his sleep. Clerk, L.J., directed the jury to find that the prisoner 'had killed his child when unconscious of the act, by reason of his condition as a somnambulist, and that he was not responsible for his actions.' ('Brit. Med. Jour.,' 1878, ii. p. 108.) In *Reg.* v. *Byron* (Winchester Wint. Ass., 1863), it was proved that a blow struck by a drunken person during sleep had caused death. The prisoner and the deceased were soldiers in the same regiment. The prisoner was in the street drunk, and the deceased, seeing this, took him in, to prevent his being arrested for drunkenness, and placed him on his bed. In this state he lay for some time drunk and insensible. In the course of the afternoon the deceased went upstairs to see him; he tried to awaken him, when the prisoner suddenly kicked out, and his boot came violently against the lower part of the abdomen of the deceased. The prisoner did not awake, but appeared then to be quite insensible. The deceased died, and it was found that the blow had caused rupture of the intestines. As in order to constitute the crime of manslaughter, it must be shown that the person charged did something knowingly, and the prisoner was not in a state to have known anything, it was held that there was no case against him, and he was acquitted. The act was committed during sleep, but the sleep was the result of voluntary drunkenness.

Somnambulism may become a subject of discussion under a contested policy of life insurance, in which it may be provided that it shall be vitiated by suicide. If a man falls from a height and is killed while in a state of somnambulism, would this be considered an act of suicide within the meaning of the policy? The proviso against suicide has been held to include only *intentional* killing (case of *Borradaile* v. *Hunter*, 'Lond. Med. Gaz.,' vol. xxxvi. p. 826), and in death under these circumstances the killing cannot be said to be intentional: it can be regarded only as an accident—therefore it is reasonable to infer that the policy would not be void. It is impossible, however, to lay down any general rules relative to cases of this description, since the circumstances attending each case will sufficiently explain how far the act of murder or suicide has been committed during a state of somnambulism, or under an illusion continuing from a state of sleep.

THE DEAF AND DUMB.

It was formerly laid down in the law-books, that a person born deaf and dumb was by presumption of law an idiot, but in modern practice, want of speech and hearing does not imply want of capacity either in the understanding or memory, but only a difficulty in the means of communicating knowledge; and when it can be shown that such a person has understanding, which many in this condition reveal by signs, he may be tried, and suffer judgment and execution. A deaf-and-dumb person is not incompetent to give evidence, unless he is also blind; he may be examined through the medium of a sworn interpreter who understands his signs. This condition does not justify restraint or interdiction, unless there is at the same time mental deficiency. A deaf-and-dumb person who has never been instructed is altogether irresponsible for any action civil or criminal. Such a person cannot even be called on to plead to a charge, when there is reason to suppose that he cannot understand the nature of the proceedings. A deaf-and-dumb woman was charged with cutting off the head of her child. By signs she pleaded 'not guilty,' but she could not be made to understand the nature of the other proceedings against her. Upon this she was discharged, and subsequently confined as a criminal lunatic. In *Reg.* v. *Goodman* (Stafford Sum. Ass., 1841), a deaf-and-dumb man was convicted of theft and sentenced to imprisonment. He was made to comprehend the proceedings by signs and talking with the fingers. In *Reg.* v. *Brook* (Buckingham Sum. Ass., 1842), the prisoner could read and write well. He was charged with feloniously cutting and stabbing. The proceedings were reported to him in writing. He was convicted, and the judge, having sentenced him to a year's imprisonment, handed down his judgment in writing, which he recommended him to read and ponder over in prison. In *Reg.* v. *Jackson* (Bedford Sum. Ass., 1844), Alderson, B., held that, before the evidence of a dumb witness can be received, the court must be satisfied that he understands the obligation of an oath.

It has been decided in the Ecclesiastical Courts that the consent of a deaf-and-dumb person, given by signs, renders a matrimonial contract valid, provided the person has a full and proper understanding of their meaning. An incompetency to enter into contracts, or unsoundness of mind, must not be inferred to exist merely in consequence of a person being deaf and dumb. In the case of *Harrod* v. *Harrod* (Vice-Chanc. Ct., June, 1854), an attempt was made to deprive the plaintiff of his rights on the ground that he was an illegitimate child. The marriage of his parents took place thirty years previously, but the marriage was said to be void by reason of the alleged incapacity of his mother to enter into the contract; the mother was deaf and dumb, and of more than ordinarily dull intellect. Wood, V.C., said there was an important difference between 'unsoundness of mind' and 'dulness of intellect.' The presumption in such cases was always in favour of sanity, and the fact of a person being deaf and dumb did not raise a presumption the other way. Experience showed that the deaf and dumb were not necessarily of unsound mind. The woman had assented to the marriage in form and substance, and with a perfect knowledge of what she was doing. In the ceremony of marriage it had never been held that the repetition of the words was necessary. The woman conducted herself with great propriety before and after the marriage, and a child was born in due course. There was no ground for an issue.

Feigned Deafness and Dumbness.—From these statements it will be perceived that medical evidence is of but little importance in relation to the deaf and dumb. Indeed, there are only two cases in which this kind of evidence is likely to be called for: first, when there is accompanying *mental deficiency*, in which case the general rules elsewhere given are applicable; and second, when there is a suspicion that the deafness and dumbness are *feigned*. There will be no great difficulty in detecting an imposition of this kind. It may be found that the alleged deafness and dumbness did not come on until a motive existed, and that there was no apparent cause but the very suspicious one of evading responsibility for some offence committed. It requires great skill to maintain an imposture of this kind. Such persons are immediately thrown off their guard by addressing them in a voice a little above or a little below the common conversational tone; when a change in the eye or the features will at once indicate that they hear and understand what is said.

In *Reg.* v. *Yaquierdo* (Herts Sum. Ass., 1854), the prisoner, who was charged with murder, was found by the jury to be wilfully mute. The man refused to plead, although it was obvious that he was well aware of the nature of the proceedings. No counsel could be assigned to him, as this could not be done without the prisoner's consent. He was convicted. Shortly after the trial, this man was found to be insane, but not mute.

If the impostor can write, he may perhaps be detected by the ingenious plan adopted by the Abbé Sicard. When the deaf and dumb are taught to write, they are taught by the eye. The letters are only known to them by their form, and their value in any word can be understood only by their exact relative position with respect to each other. A half-educated impostor will spell his words or divide them incorrectly; and the errors in spelling will always have reference to sound—thereby indicating that his knowledge has been acquired through the *ear*, and not alone through the eye. A man who had defied all other means of detection wrote down several sentences, in which the misspelling was obviously due to errors produced by the *sound* of the words, thereby showing that he must have heard them pronounced. The Abbé concluded, without seeing him, that the man was an impostor, and he subsequently confessed the imposition.

LIFE INSURANCE.

CHAPTER 68.

PRINCIPLES OF LIFE INSURANCE.—MEDICAL RESPONSIBILITY.—WHAT DISEASES HAVE AND WHAT HAVE NOT A TENDENCY TO SHORTEN LIFE?—CONCEALMENT OF DISEASES.—CONCEALMENT OF HABITS.—MATERIAL CONCEALMENT. — WHAT IS INTEMPERANCE? — PROXIMATE AND REMOTE EFFECTS.—OPIUM-EATING.—INVETERATE SMOKING.—INSANITY.—VOIDANCE OF POLICIES BY SUICIDE.—INSURANCE MURDERS.

The insurance of a life is a contract whereby the insurer, in consideration of a certain sum of money called a *premium*, either in a gross sum or in periodical payments—proportioned to the age, sex, profession, health, and other circumstances of the person whose life is insured—undertakes to pay to the person for whose benefit the insurance is made, a stipulated sum, or an equivalent annuity, upon the death of the individual whose life is insured (or on his obtaining a certain age), whenever this event shall happen, if the insurance is for the *whole* life: or, in case this shall happen within a certain period, if the insurance is only for a limited time. The deed by which this contract is made is called a *policy*, and it is concerning the stipulations of the policy, and the meaning to be put upon certain medical terms used in it, that litigation commonly arises. The amount of premium payable will be regulated by the mean expectation or duration of life of the individual; and this it is well known is not only different at different ages, but is greater at certain periods of life among women than among men.

The sum for which a person's life has been insured cannot be recovered until after the death of the person, and distinct proof of death. Those who would benefit by the death must prove the fact of death when this is open to doubt. A man suddenly disappeared while at Brighton, within a week after an insurance had been effected on his life. The man's clothes were found on the beach, and the jury were asked to infer from this fact that the man was drowned while bathing, and that his body had been carried out to sea. No one had seen him go into the water. The jury were discharged without a verdict. It was quite possible that the clothes had been designedly placed there, and that the man had gone off in another direction, and was then living.

Since the above was written by the author of this work, the editor has met with a remarkable case. In the autumn of 1878, a young merchant was staying at an hotel in Barmouth. One morning he went to bathe alone from the beach. His clothes, containing money and his watch, were subsequently found; but the body of the supposed drowned man was not found. An insurance on his life was paid. Six months after, the supposed deceased was recognized and challenged in South America by a friend; and the insurance money had to be refunded. The missing man had been in pecuniary difficulties. He took with him to bathe an extra suit of clothes, and decamped, leaving money in the pockets of the clothes on shore, in order to divert suspicion.

Different rules have been given by actuaries for calculating the expectation or duration of life at different ages. One of the most simple of these rules for calculating the duration of life from five to sixty years, has been given by Willich: he considers the probable duration to be equal to two-thirds of the difference between the age and eighty. Thus in a man twenty years of age the difference is equal to sixty; and two-thirds of this age, or forty years, is the probable duration of life for a person of average health at twenty.

With respect to the influence of *profession*, a higher premium is demanded by some offices for the insurance of the lives of persons whose occupations expose them to great risk—as, for instance, of persons actually engaged in military or naval service.

Above all other conditions, *the general state of health* of the person is likely to have a most important influence on the mean duration of life; and it is here that medical science lends its aid—first, by showing how far a contract may be safely entered into when the person is affected with disease; and second, by showing whether a diseased state of the body really existed in the person insured, although at the time of insurance it may have been alleged that he was healthy and free from disease.

As in the case of all civil contracts, the law requires that there should be a strict compliance with the conditions by each party, it follows that if any fraud had been committed by the insured—if he, or those to whom he trusted in his dealings with the office, have concealed from the insurers the existence of any disease under which he was at the time labouring, or any symptoms indicative of a probable attack of disease; or if he or they have knowingly or wilfully misrepresented his actual bodily condition,—then the contract will be void, and the amount of the premiums forfeited. This forfeiture is a usual condition in the policy. Actions on policies of life insurance are not unfrequent. In a case of life insurance an action is never likely to be brought for the recovery of the amount of a policy, except when there is reason to believe that a wilful fraud has existed in the contract. Juries always regard such actions with disfavour; and, while judges interpret the law strictly, the onus of proof is entirely thrown on the offices. Hence the insured are placed in a very advantageous position. These actions, in nine cases out of ten, depend upon the construction put on the medical terms of the contract; hence it is our duty to see how medical defects are likely to arise in reference to the policy.

The Relations of Medical Men with Insurance Offices. Medical Responsibility.—The practice with some offices, of obtaining a certificate gratuitously from the medical attendant of the person proposing to insure his life, is one great source of litigation. The responsibility of causing the life to be accepted or rejected is thus thrown entirely upon the usual medical attendant of the person; for, as we shall see hereafter, an application for a certificate from a medical practitioner who is a stranger, is very likely to be treated as a fraud, and may lead to the disputing of the policy. The medical attendant of the person, it is true, is the only individual who can properly certify to the real state of *previous* health, and therefore to him an application is generally made. He is sometimes expected to furnish an important certificate of this kind gratuitously; and should it happen to be unfavourable, he is exposed to the risk of losing what may probably be a lucrative portion of his practice. The question is, whether an insurance office has a right to place a medical man in such a position as this. In the issuing of the policy the insurers and insured are equally benefited, for the contract would certainly not be made except upon a supposition of reciprocal advantage. The medical attendant, without whose sanction the policy could not in all cases be properly effected, not only derives no benefit, but is actually exposed to the risk of loss for performing in an honourable and conscientious manner an invidious duty thus forced upon him. Such a state of things ought not to be. Many actions for the recovery of disputed policies have shown clearly that the practice leads to great carelessness and indifference on the part of medical men in drawing up these certificates, and this produces in the end a more serious loss to the representatives of the insured than if the life had not been accepted. It must be remembered that it is not the insurers who suffer by misconduct on the part of a medical man who signs such a certificate, but the representatives of the insured. It is always professed that such communications are confidential; but in more than one instance medical men have found that the contents of their certificates have become known to their patients, and have even been publicly used as evidence in courts of law.

In the event of a medical practitioner being called upon to sign a certificate of this kind, the safer course would be that he should decline the proposal, except upon a professional consultation with the medical officers appointed by the insurers. If, however, from private considerations he is compelled to sign the certificate, it is his duty to use the greatest caution, not merely in returning answers to the formal questions on the paper, but in detailing *all particulars known to him respecting the state of health of the person.* In acting otherwise, he would be doing the greatest possible injury to the representatives of the insured, and probably damage his own reputation. There is no intermediate course: the duty must either be performed carefully, conscientiously, and honourably, or it must be declined altogether. It is a fallacy to suppose that any equivocation or concealment in the declaration can escape detection; and yet, from the evidence which has been given at some trials, it is probable that such an idea had existed in the mind of the medical attendant who attached his name to the certificate.

Diseases tending to shorten Life.—Let us take the case, however, that this preliminary duty has been properly performed; important medical questions may arise respecting the alleged infringement of the conditions of a policy. The list of diseases specified in the inquiries comprises a great variety—affections of the head; apoplexy, palsy, epileptic or other fits; disease of the brain, insanity; disease of the lungs, spitting of blood, asthma, inflammation; disease of the heart; dropsy; diseases of the bowels, liver, kidneys, or urinary organs; gout, rheumatism, hernia; phthisis, or any hereditary malady.

In the proposals of some offices, the mysterious word 'fits' occupies a very prominent position, but it is difficult to say what this word thus isolated actually means. Thus it may comprise apoplexy, epilepsy, paralysis, syncope, convulsions from any cause, and even asphyxia. The word is too indefinite for a certificate, and should be expunged. In the mean time, a court of law will not allow insurers to benefit by the use of ambiguous terms in the contract, and it has therefore commonly restricted the meaning of the word 'fits' to attacks of epilepsy. The main condition, however, is evolved in the terms—'*any other disease or disorder tending to shorten life.*' Upon the meaning of these words litigation commonly turns, and the opinions of medical experts are required.

It is impossible to lay down any general rules for determining what diseases have, and what diseases have not, a tendency to shorten life. Any deviation from health might be so interpreted; but the law puts a proper limitation here upon the meaning of the words, considering them to apply to those diseases only which, in a medical view, are regarded as of a serious nature, and, as a general rule, are likely either directly or indirectly to affect the duration of life of any person labouring under them. A disease tending to shorten life must not be taken to signify only one of those maladies which have commonly a rapid and fatal course, as phthisis and scirrhus; it may apply to dropsy, gout, asthma, insanity, and many diseases of a chronic character. When the existence of these diseases, or even a well-marked *tendency* to them, is concealed from the insurers, or omitted to be stated through mistake—even without fraudulent intention—the policy in the event of death becomes void, because the risk incurred is really different from the risk understood and intended at the time of the agreement. Such diseases are not necessarily fatal; but this is not the question: their *tendency* is to diminish the expectation of life, and if medical evidence establish this with regard to any disorder intentionally concealed, whether chronic or acute, the contract is at an end.

Habits.—A person may be labouring under no actual disease at the time of effecting the insurance, but his *habits* may be such as to produce general injury to health, and to have a tendency to shorten life. Concealment of habits the effect of which on health must or ought to be known to all medical men, may be just as fatal to a policy as the concealment of a serious disease. Although they may not always be included in the questions put by the office, yet the law will hold that the insurers should be made acquainted with all circumstances which might reasonably affect the risk. Concealed habits of drunkenness have thus given rise to medical questions of considerable importance; and in one remarkable instance, which will be mentioned hereafter, a question arose as to whether the practice of opium-eating, which had been concealed from the insurers, had or had not a tendency to shorten life. Some exposures, partly of a civil and partly of a criminal nature, have rendered insurance offices much more strict in their inquiries. In the rules already quoted, special information is demanded upon the existence of material circumstances touching health or habits of life, and whether the person is or is not of temperate habits. Any facts bearing upon these questions, if known to the medical attendant, must of course be stated. The existence of such habits must be known to the person himself, and the declaration which he signs is so explicit that, if there be intentional concealment by him, no individual can reasonably complain of the violation of the policy and the forfeiture of the premiums.

Material Concealment.—Some medical practitioners entertain the opinion that, provided they can certify that the person is in good health at or about the time of the insurance, this is all that the insurers need know. The same opinion is commonly entertained by the insured, and the latter, after having been attended by one medical man for an illness, will apply to another, a comparative stranger, to certify to his condition of health for insurance. We must not lend ourselves to this system, which is based sometimes upon a mistake, at others upon fraud. If medical men would decline signing the papers under such circumstances, they would not only save themselves from censure, but be actually conferring a benefit upon the applicant, by preventing him from obtaining a policy upon terms which on his death may render it invalid, and entail a forfeiture of the premiums. From what has already been said, it will be understood that the exact state of health of the person at the time of the insurance does not represent the whole of the risks incurred by the office. The restoration to health, as in a case of diseased lungs, may be only temporary; it may be speedily followed by phthisis, and the insurers, therefore, ought to be informed of the previous condition as well as the present state of the applicant. The conditions in the declaration are so explicit upon this point as to render it scarcely necessary to refer to the propriety of making this addition to the certificate. The disease under which the insured had laboured may have been of a trivial kind, and not likely to affect the risk; nevertheless, the safer plan is to state it. The option will then lie with those who are to incur the risk. When facts of this kind are either concealed or not plainly stated, the question of how far they were or were not material to be laid before the insurers is always left to the jury, who are guided in their verdict by their own common sense as well as by medical opinions.

Some medical men have adopted the plan of signing certificates, but have declined to make any written reply to certain queries; as, for instance, the general query—'Can you give any and what information respecting the habits of the applicant?' If nothing be known concerning these, it should be so stated; if, however, the existence of any habits affecting health be known to us, we shall do an injury to the applicant and ourselves by withholding information on the subject. It may be the means of causing a heavier premium to be demanded for insurance than if the facts were known, and if this should not happen, the omission is very likely to give rise to future litigation.

If, under any circumstances, a jury should find that the concealment is material, the legal consequence is that the policy is void. It is not at all necessary that the person should die of the disease concealed. This rule was laid down by Lord Tenterden, in the case of a *Colonel Lyon*. The colonel insured his life by two policies in May and June, 1823, and died of a bilious remittent fever in October following. Payment was refused, on the ground of misrepresentation and concealment. Colonel Lyon referred the office for a certificate of his health to a gentleman who had not attended him for three years previously. His answers to the printed questions were that he had had no other medical attendant, and that he had never had a 'serious illness.' The medical man to whom he referred certified that his life was insurable, and the policy was issued. It appeared in evidence, however, that the deceased had been attended by two other medical men from Feb. to April, 1823, for hepatitis, fever, and a determination of blood to the head. One of these employed very acute treatment; he considered him to be in a dangerous state, and would not have certified him to be in health until the end of May, 1823. All agreed that the deceased did not die of the disease for which he had been thus attended. Lord Tenterden stated it to be his opinion that, if a man referred to one practitioner, because he could speak well of his health, and thought that if he referred to other medical men they would not so certify, although the insured did not die of the disease with which he was then afflicted, the policy would be void. A verdict was accordingly given for the defendants.

The practice of referring to medical men who have been only recently consulted is not infrequent. The opinion of the usual medical attendant might be unfavourable, or he might report on the existence of habits which would render the life uninsurable, or insurable only at a high premium. This want of fair dealing, however, commonly defeats its object. There is expensive litigation, and the policy is pronounced to be void.

Among the diseases upon the concealment of which policies have been most frequently disputed, may be enumerated gout, dropsy, paralysis, epilepsy, hæmoptysis, incipient phthisis, delirium tremens; and to this list may be added drunkenness, intemperance, and irregular habits.

Intemperate Habits.—In a large number of cases the payment of policies is resisted on the ground of concealed drunkenness and general habits of intemperance. There is some difficulty in those cases, because medical men may entertain different opinions respecting the effects of such habits upon the general health, and the degree to which they may be safely carried. There is one thing, however, certain—whatever may be our opinion of their effect on health, we are bound to state, if known to us, that they exist, and thus put it out of the power of a company to dispute a policy upon such a ground. From the frequent concealment of habits of this kind, some offices now adopt the practice of making it a special question, to which a plain negative or affirmative answer should always be given—'Are you now, and have you always been, of temperate habits of life?'

It is well known that 'intemperance' is a relative term, and may be differently construed by different medical witnesses. The real question, however, divested of its sophistry, is this—Can any person indulge in an excessive use of alcoholic liquids without this practice sooner or later leading to an impairment of health, by producing disorder of the stomach and liver, and remotely affecting different organs? The effects of such habits may not show themselves immediately; but the office requires to be informed of their existence or non-existence, and not of the period when they are likely to affect health visibly, or to engender a fatal disease. To assert that a man can be addicted to excessive drinking without impairing his health, is contrary to experience. There is no such compensation or balance of habits as is supposed to exist in these cases. Habit may accustom a man to intemperance—it may enable him to drink a large quantity of alcoholic liquid without being apparently injuriously influenced by it at the time; but a deranged state of the system will sooner or later follow, and delirium tremens or dropsy will probably supervene. A good constitution may enable a man to resist the pernicious effects for a certain time; but ultimately they will show themselves in some form of disease, and the result of his intemperance is made apparent in his early death. It is unfortunate that no light is permitted to be thrown on such cases by pathology. Post-mortem examinations are not always made in these cases; for the death being, as it is called natural, it is not commonly thought necessary to inspect the body, although the condition of the liver and other organs might at once remove any difficulty which arose from the conflicting evidence on the habits of the deceased. In all cases of a contested policy, one important principle is uniformly acted upon—those who resist the payment are bound to prove what they allege by conclusive and satisfactory evidence. A court will not receive probability or conjecture; the evidence must be certain. Hence many suits fail from the medical evidence going no further than to show that a particular disease or habit had *probably* existed at the time of insurance. If the disease or habits be shown to have *certainly* existed, the evidence may still fail to prove satisfactorily that the concealment was either wilful or material.

Contested cases of life insurance often show the imperfect manner in which medical observations respecting health or disease are made, and that the medical treatment of persons whose lives are insured may become a material question in the event of a policy being disputed. In the case of *Chattock* v. *Shawe*, in reference to an insurance on the life of Greswold, a question arose, not only concerning the concealment of intemperate habits, but as to the concealed existence of delirium tremens—from the examination of handwriting, as well as from the description, given by non-professional witnesses. It was here even doubtful what had caused the death of the deceased. According to one medical witness, it was a curious combination of Asiatic cholera, phrenitis, and epilepsy. It was proved that, more than three years before the insurance was effected, this man had met with a fall, and he was afterwards seized with a fit, described by some witnesses as epileptic, by others as arising from concussion of the brain. The existence of intemperance and epilepsy prior to the insurance was not made out to the satisfaction of the jury, and they returned a verdict for the representatives of the insured.

Opium-Eating.—There is another habit the concealment of which gave rise to an important trial—the practice of opium-eating. The *Earl of Mar* effected an insurance on his life, and two years afterwards, *i.e.* in 1828, he died of jaundice and dropsy at the age of fifty-seven. The insurance company declined to pay the amount of the policy, on the ground that the earl was, at the time of the insurance, and had been for some time previously, an opium-eater. This practice was concealed from the insurers; and it was further alleged that it had a tendency to shorten life. It was clearly proved in evidence that the earl had been a confirmed opium-eater up to the time of his death. According to Christison, the deceased had taken laudanum for thirty years, at times to the amount of two or three ounces daily—a tablespoonful for a dose. He was a martyr to rheumatism, and, besides, lived rather freely. Many persons who were constantly about him, and many intimate friends, deposed that until the year of the insurance he was of a cheerful disposition, and clear in his intellect. Some of them admitted that they then perceived a change in his habits, which they attributed to the adverse circumstances in which he was compelled to live. In 1825 Abercrombie found him enfeebled and broken down in constitution, but without any definite complaint. The main question at the trial was whether opium-eating had a tendency to shorten life—for on this the issue turned—whether concealment from or the non-communication of this practice to the office was or was not material. Christison, Alison, Abercrombie, and Duncan were examined on the part of the insurers; and although they entertained the opinion that the habit had a tendency to shorten life, they were unable to adduce any facts or cases in support of it. Their opinion was based, not on personal experience, but on the general effects of opium as manifested by its action on the brain, by its producing disorder of the digestive organs, and giving to the person a worn and emaciated appearance. In most of the instances collected there was no evidence that life had been shortened by the practice. On the contrary, some of the persons had carried it on for years, and had attained a good old age. The jury returned a verdict for the plaintiffs, not on the ground that the practice was innocuous and its concealment immaterial, so much as on the technical point that the insurers had not made the usual and careful inquiries into the habits of the deceased; and they were therefore considered as having taken upon themselves the risk from their own *lâches.* It appears that the general question with respect to habits was not answered by the medical referee, and it was therefore considered that the office had waived the knowledge of them. A new trial was granted on the ground of misdirection, but the suit was compromised.

Hence no decision was come to in this case on an important question, which is very likely to arise again. It will be desirable, therefore, to examine some of the facts connected with opium-eating, in order, if possible, to see how far it really tends to shorten life. In the case of the Earl of Mar, it appeared to be a fair inference that the habit did not shorten his life, for he is represented to have indulged in it for thirty years; and for twenty-eight years, according to the statements of his friends, no injurious effects had followed. Christison subsequently collected from numerous sources no fewer than twenty-five cases, from which we learn that opium has been taken in large quantities for forty years together without producing any marked injury to health.

On the whole, however, we are bound to conclude that the habit of opium-eating is, as a rule, injurious to health, and is therefore calculated to shorten life. In any proposal for life insurance, the insurers should be informed of this habit when it exists, and no medical man should sanction its concealment merely because many persons addicted to it have lived for years in apparently tolerable health. One of the questions put to a medical man is, whether he knows any material circumstance touching the health or habits of the person, to which the other inquiries in the certificate do not extend, and, if so, he is required to state them. Now, without going the length of saying that the life of an opium-eater is uninsurable upon a common risk, the habit is itself sufficiently material to require that it should be declared in reply to such a question as this. The practice may be, and often is, concealed from a medical attendant: then the insured, if not candid in avowing its existence, must expose his representatives to the risk of losing all benefit under a policy. Independently of medical facts, which appear to favour both sides of the question, a jury would probably be guided to a verdict by the effect actually produced on the constitution of a person who has been addicted to the practice. If it has continued many years, and there is no proof of his health having in consequence undergone any remarkable change, this might be regarded by the jury as the best possible evidence in favour of the concealment not being in such a case material. The insurers could not equitably complain of the verdict in the Earl of Mar's case, for as he began opium-eating at twenty-seven, and died at fifty-seven, without any obviously injurious effects being produced by the use of the drug, it could not be said that in his case at least the practice had shortened life. It is rarely in our power to apply any better or more practical test than this, under circumstances in which medical facts appear to bear both ways. The case is very different from intemperance in the use of alcoholic liquids; and no one can doubt that in this form the results must be inevitably to impair health and to shorten life. The facts here bear one way, and if instances of longevity can be adduced among spirit-drinkers, they are well known and generally admitted to be exceptions to the rule. The queries put by insurance offices are now so explicit, that they must be considered as including the habit of opium-eating; and there does not appear to be any just pretence for evading the admission of the practice, either on the part of the insured or (if known to him) of his medical attendant.

Tobacco-Smoking.—The prevalent habit of smoking tobacco has never been adequately regarded in relation to life insurance. Although excessive smokers are liable to attacks of dyspepsia, loss of muscular and nervous power, weakness, amaurosis, and other derangements of the system, there is no evidence to show that the practice has a tendency to shorten life. The habit should be stated in the certificate, if known to the medical referee and to be of an inveterate kind. (See 'Ann. d'Hyg.,' 1866, t. 2, p. 152.) This would at least prevent objections on the part of a captious company. There is no rule of law on this point, if we except a dictum of Lord Mansfield: 'The insured need not mention what the insurer ought to know, what he takes upon himself the knowledge of, what he waives being informed of; the insurer need not be told general topics of speculation.'

Insanity.—When we are called upon to say what *diseases* have a tendency to shorten life, there is commonly no difficulty in giving a reply, since the name of the disease, its known effects upon the body, the degree of the mortality produced by it, and its intractableness, are data upon which a medical opinion may be easily expressed. There are some diseases, however, respecting which it is not so easy to return an answer; and among these may be mentioned *insanity*, which has already given rise to discussion in a court of law. The treatment of this malady falls out of the usual line of practice; and there are comparatively few in the profession who have made themselves acquainted with statistical details respecting it.

There was formerly a notion that insanity had a tendency to prolong life; but statistics have shown that the insane are more liable than the sane to various diseases, and that when attacked they sink more easily under them: hence the mortality of the insane, *cæteris paribus*, is much above the average of that of the sane population. Among other fatal diseases, the insane are specially liable to attacks of paralysis and epilepsy; and paralysis, however slight, is commonly the forerunner of death in these cases. In private asylums, the mortality is always less than in public hospitals; but researches have proved that the mortality of the insane has been much reduced by the introduction of an improved system of management and treatment.

Observations have shown that the mortality among male is greater than among female lunatics, and the more advanced the age, the greater the proportionate rate of mortality. The concealment of insanity in any of its forms, or even the concealment of a known hereditary tendency to this malady, would be considered material, insomuch as either condition forms a special question to which a direct answer should be returned.

Suicide.—Among the conditions in policies of insurance, there is generally a stipulation in the contract that the policy shall be void if the person who insures his life commits suicide. Thus a medical question may arise as to whether suicide was or was not committed in a particular case. A person may die from poison, wounds, drowning, or other forms of asphyxia; and it may be difficult to say whether, in certain cases, the death arose from accident, suicide, or from violence inflicted by another. Such cases are often left in great uncertainty at coroners' inquests—the evidence received being imperfect or insufficient; because in cases of sudden death, provided there be no suspicion of murder, it is considered of little moment to make a strict inquiry. If the life of the deceased should happen to be insured under a policy containing this condition respecting suicide, the question may become of great importance to the interest of the insurers, and they will require clear evidence that the death was natural or accidental, and not suicidal, before paying the amount of the policy. The cause of death should in all cases of violence be determined by a medical man; this will put an end to any dispute concerning the payment of the policy, and relieve the representatives from the trouble and expense of litigation. If the death be sudden, and any suspicious circumstances are left unexplained, a civil action may follow. We are not, therefore, safe if at a coroner's inquest we suppose that we have only to satisfy a jury by a hasty opinion expressed from an external view of the body, or an ill-conducted inspection, merely because it may appear to us quite certain that the deceased could not have been murdered. Should the deceased be one of that class of persons on whose lives insurances are commonly effected, the whole of the circumstances connected with the examination of the body, and the medical opinion of the cause of death, must come to light, and, if the examination was carelessly performed, will probably be made the subject of a severe cross-examination. There have been several painful exposures of this kind, because the medical witness thought any kind of evidence would serve the purpose of a coroner's jury. The verdict of a jury at an inquest is not binding on a company; they have not only a right, but often good reason to dispute it, and they frequently exercise this privilege. The insurance companies are exposed to all kinds of frauds, actually leading, as in the case of burial clubs (a kind of life insurance), to the perpetration of murder for the sake of the small amount insured.

Among the medico-legal questions connected with this subject is the following:—Does the proviso in the policy respecting suicide include all acts of self-destruction; or is it restricted only to those cases in which a sane or a partially insane person consciously destroys himself? This question has been elsewhere fully considered. The act of suicide does not necessarily indicate insanity; but even if it did, the rule of law, as settled by a majority of the judges in reference to this proviso in cases of life insurance, is that, whenever an insured person destroys himself *intentionally*, whatever may be the state of his mind, the policy is void. If a person, whether sane or insane, kills himself *unintentionally*, then the insurers are liable; but the onus of proof in this case lies upon the plaintiffs, *i.e.* those who would benefit by the policy. A question here arises—Can an insane person be said to have the same 'intention' to destroy himself that could be ascribed to one who was sane? Is not the intention affected by the state of insanity? This may in some measure depend on the degree which the mental order has reached. According to Tardieu, the decision of a French tribunal on this subject, Aug. 8, 1854, was to the following effect: 'Whosoever has caused his own death under an attack of insanity, cannot be considered to have fallen a victim to "suicide" in the sense in which this term is used in policies of insurance' ('Ann. d'Hyg.,' 1864, t. 2, p. 394.) According to the practice of some British offices, the act of suicide does not render a policy void; but in the Government life insurances, there is a provision to the effect that they will be void in case of death by the hands of justice or by suicide.

Insurance Murders.—The insurance of the lives of others has been considered to be objectionable, on the ground that it tends to create an interest in the death of a person, and thus to lead to secret acts of murder. The 14 George III., c. 48, expressly enacts that no insurance on a life shall be valid, unless the person insuring has a direct legitimate interest in the person whose life is insured. This statute was enacted for the purpose of preventing gambling in policies, and to guard society against the risk of persons insuring, and then contriving the death of the insured, for the sake of the payments to be made under the policy. Its effect is simply to render the policy void; it does not require that the premiums shall be refunded, nor does it award any penalty to the offenders. As policies of life insurance may be bought and sold like other property, they may fall into the hands of persons who have no other interest in them than the desire that such policies should speedily become claims by the death of the insured. The interest of such holders, it has been justly observed, lies in the *death*, and not in the *life*, of the insured.

The recent revelations at Liverpool (*Reg:* v. *Flannagan and Higgins*, Liverpool Feb. Ass., 1884), and certain facts relative thereto which have since come to the editor's knowledge, show what terrible prevalence there is of murder for the purpose of procuring insurance moneys; and point to the extreme necessity that exists, in consequence of the lax way in which small policies are effected, of medical men being careful as to the giving of death certificates.

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